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**AN ENVIRONMENTAL ASSESSMENT**

**THE SUSTAINABLE FORESTRY MANAGEMENT PROJECT**

**EXECUTIVE SUMMARY**

**Prepared by:**

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**For: USAID/Bolivia**

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## **EXECUTIVE SUMMARY**

### **ENVIRONMENTAL ASSESSMENT**

#### **THE SUSTAINABLE FORESTRY MANAGEMENT PROJECT**

##### **Project Goal:**

The goal of the proposed project is to reduce degradation of forest, soil and water resources and help conserve Bolivia's biological diversity.

##### **Project Purpose:**

The purpose is to build Bolivian public and private sector capacity to develop and implement programs for sustainable forest use. This will be accomplished through a tightly integrated set of activities including applied research, training, natural forest management demonstrations, value-added enterprises and marketing, and policy analysis and dialogue.

If the purpose stated above is achieved, the majority of the forests of Bolivia will be under legally defined and internationally certified site-specific management plans, either for the forest unit as a whole or for specific products. Progress will be measured by the establishment of commercial scale models of sustainable use based on research results.

##### **Project Activities**

The primary and supporting project activities listed below are described in detail in the Project Paper. The primary project activities include:

- \* Natural forest management
- \* Value-added enterprise development
- \* Marketing of timber and non-timber forest products
- \* Monitoring and evaluation

#### Supporting project activities include:

- \* Applied research
- \* Training and information dissemination
- \* Policy analysis and dialogue

#### Conclusions

1. The timing of the Sustainable Forest Management project is ideal. Bolivia has enacted legislation, the *Pausa Ecológica*, requiring by 1995 that forest products exported be certified by the GOB as coming from sustainably managed forests (Decreto Supremo 22884). This project can play a key role in providing the technical basis for helping Bolivia achieve its 1995 goal.
2. International certification that timber and non-timber products come from sustainably managed forests will soon become a significant factor in world markets. The European Community led by Germany, has given Bolivia notice that it intends to close its markets to uncertified timber products. A.I.D. regulations concerning tropical forests strongly complement certification guidelines. The project will vigorously promote certification both technically and in policy dialogue.
3. A conditionality on the sustainability of forest management from an ecological and social perspective will be adherence to a combination of national and international certification requirements. Why this caveat? According to the 1992 World Bank Forest Sector Review, trees and wood prices tend to increase slowly, while real interest rates in Bolivia have been around 15-20 percent. As long as investing elsewhere is more attractive than allowing trees to grow, rapid depletion of marketable timber will continue unless constraints are enforced.
4. Several issues beyond the direct purview of this project will, never-the-less, have a significant influence over its orientation and degree of success. Issues in various stages of political discussion include:
  - \* Secure access to land and forest resources (a major World Bank project will address this issue)
  - \* Greater transparency in the granting and transfer of forest concessions
  - \* Resolution of indigenous land claims in the Bolivian Oriente
  - \* Government's will to pass an effective forest law and enforce related regulations

#### Background

The Sustainable Forestry Management Project is the first project in the Latin America and Caribbean region to employ the Design and Performance (DAP) mechanism for contracting. In many ways the project will break new ground, both in the collaboration of contractor team with USAID and Bolivian institutions during design, and in the dual emphasis on forest production and protection. FONAMA (the Fondo Nacional de Medio Ambiente) and SENMA (Secretaría Nacional del Medio Ambiente) have played a major role in project design with important contributions from the Centro de Datos para la Conservación (CDC), Bosque, Conservación y Manejo (BCM) and the Ministerio de Asuntos Campesinos y Agricultura (MACA). Closely involved are the Agriculture and Rural Development Office and PL-480 program of USAID/Bolivia.

Half of Bolivia is covered by lowland tropical forest, but less than 10 percent is in parks. The vast areas of forest outside the parks are subject to degradation by inappropriate logging practices or conversion to cropland and pasture. Some 22 million hectares are currently under forest concession for the extraction of timber with overlapping concessions in some areas for products such as palmito, Brazil nut and rubber. It is the challenging premise of this project that sustainable management of forest lands will result in:

1. The maintenance of a flow of timber and non-timber forest products competitive with returns from conversion of the land to other uses
2. The maintenance of a large measure of biological diversity, ecosystem structure and other values of importance to society

The sustainability of forest management from an ecological and social perspective will be defined and enforced through adherence to a combination of national laws and international certification requirements.

### Major Project Elements

To achieve the dual goals of production and protection, requires tight integration of components. The capital intensive business of processing forest products cannot be sustained without the forest, nor can the products be sold abroad unless equal attention is paid to maintaining biological diversity and growing trees. Since putting this novel concept into practice is new, it must be supported by applied research, training and broad dissemination of results in a favorable policy environment. This complex process must be closely monitored and timely adjustments made if the goals are to be achieved.

The project encompasses the tropical forests of eastern Bolivia. However, initially the geographic focus will be on two sites:

- \* Moirá - The 150,000 hectare Moira concession in the Bajo Paragua region of the Department of Santa Cruz. The site is flanked by the Noel Kempff Mercado National Park and the Rios Blanco y Negro Wildlife Reserve, where highly applicable ecological research has taken place.
- \* Lomerio - The Central Intercommunal Campesina del Oriente de Lomerio (CICOL) comprises some 23 Chiquitano communities southeast of Concepción in Santa Cruz Department. A well organized forestry project in this area can effectively use complementary support from the Sustainable Forestry Management Project.

Choice of a specific geographic area does not preclude the choice of other sites at later date. This site specific focus will allow the EA to explore in greater detail the potential impacts of project activities. Lessons learned during this process will help the implementation team to more precisely define subsequent assessment requirements as project activities are replicated in other areas of the Bolivian Oriente.

### Implementation Schedule

Phase I (First 12 to 18 Months) - The project implementation will begin in July of 1993. It can be assumed that the first two months will be largely spent setting up offices, establishing working relations with counterparts, and assembling supplies and equipment. Once the logistics of settling in and team formation is complete, the critical process of institutional coordination will begin. This EA covers all anticipated activities during the first 18 months.

**Phase II (18 - 36 months)** - The most dramatic addition to project activities during Phase II will be the launching of demonstration and training activities.

**Phase III (36 months to End of Project)** - By the beginning of Phase III the project should have a good idea of what sustainable forest management looks like under specific site conditions in Bolivia. By this time the Pausa Ecológica and European Community deadlines for certification of sustainability of management will have passed. A broad spectrum of the forest products industry should be ready to accept and apply sustainable management techniques.

#### Summary of anticipated Year 1 activities

The project implementation will begin in July of 1993, at the peak of the dry season timber harvesting period. Once the logistics of settling in and team formation is complete, the critical process of institutional coordination will begin. For example, CIMAR, the Centro de Investigación y Manejo de Recursos Naturales, is expected to play a key role in coordinating research and training. Data gathering in support of hypothesis testing for priority topics will begin during the first four to six months and continue into the second year. Examples include:

- \* Measurement of the impact on biodiversity and ecosystem structure of existing palmito and timber harvesting in the Bajo Paragua and Lomerio. This research will allow identification of training needs to improve the environmental performance of loggers.
- \* Baseline data gathering on fauna and key ecosystem parameters can begin early in collaboration with the herbaria, the Wildlife Conservation Society (WCS) project and other institutions.
- \* Sites for field testing of forest management strategies for timber and non-timber products can be identified.
- \* In collaboration with the marketing group, new tree species with a potential in the market can be identified for research into their regeneration and the impact of their removal on the rest of the ecosystem.

Given that baseline data gathering, preliminary research and non site-specific training will occupy much of the first year, little supplementary EA activity is expected during the first six to nine months. The activities for which this EA was prepared are expected to begin early in the next dry season. An update may be required if deviation in site or approach varies significantly.

#### **Activities Triggering the Environmental Assessment**

The principal functions of the Environmental Assessment during the project design is to serve as both a check and a design guide. The EA will assure that production which enhances the economic value of the forest, is balanced by protection that maintains the ecological values represented by the forest. The EA has been carried out in accordance with procedures called for under federal regulations (CFR 22, Part 216). In addition, Section 533(c)(3) of the 1991 Foreign Operations Appropriations Act prohibits the use of economic assistance funds for:

"any program, project or activity which would result in any significant loss of tropical forest; or involve commercial timber extraction in primary tropical forest areas, unless an environmental assessment: (i) identifies impacts on biological diversity; (ii) demonstrates that all timber extraction will be conducted according to an environmentally sound management system which maintains the ecological functions of the natural forest and minimizes impacts on biological diversity; and (iii) demonstrates that the activity will contribute to reducing deforestation."

## Tropical Forest Issues Addressed in the EA

The EA for the Sustainable Forestry Management Project is structured to address the Congressionally mandated concerns outlined in Section 1.2 above and to recommend measures which may need to be included in order to minimize potential adverse environmental impacts of project activities. The EA combines a site-specific focus on two forest management units with an overview that provides the reviewer a perspective on what activities are anticipated and how the project is likely to proceed over the next seven years.

The EA specifically addresses small plot research in tropical forests. It is important to note that none of the major forest management demonstrations and forest management plans described in this EA nor any activities requiring supplementary EAs will take place during the first year of the project. Once the project is established in the field, the team will organize and direct small plot and species specific research, inventories, and feasibility studies. Once discrete packages of information have been developed which show promise as contributions to sustainable forest use, they will be subjected to a supplementary assessment before demonstration, training and dissemination activities begin.

Impacts on tropical forests of small plot research on such topics as tree felling, log extraction, and silvicultural treatments addressed in the EA include:

- \* Impacts on the ecological sustainability of forest resource use
- \* Impacts on plant and animal populations

## The EA Team

Composition of the EA team and the timing of its activities reflects the collaborative DAP process. During the preparation of a conventional Project Paper the EA team often begins its work once the project design is nearing completion. In the case of Sustainable Forestry Management Project the EA has been conducted parallel with the Project Paper preparation. EA team members have had direct input to the design of the project, particularly in the protection component with its strong emphasis on research and training. EA team members were in the field together with the forester, marketing expert, economist and anthropologist participating in interviews, field observations and lengthy discussions on project design.

The EA Team Leader, Dr. Joshua Dickinson had sole responsibility for guiding the EA preparation, while the forest ecologist from the contractor team was responsible for both design of the research and training component and contributing to the EA. Dr. Francis Putz, the forest ecologist has a strong familiarity with forestry practices and sustainability certification procedures and therefore was able to provide a strong logical link between the production forester's perspective and the design of research to support realistic impact mitigation measures.

Balancing the contractor contribution were three scientists representing an array of environmental concerns and competencies. They had no vested interest in the outcome of the design other than to assure its environmental soundness. According to the team's Terms of Reference (attached) all EA team members must approve the final product prior to submission. The independent team members include Dr. Peter Frumhoff, an animal ecologist and biodiversity specialist serving as a AAAS Fellow with AID/EID in Washington who had participated in the BOSCOEA EA, Dr. Howard Clark, a plant ecologist serving as the Regional Environmental Advisor for South America and Dr. Jeannine Koshear, a geographer and AAAS Fellow with ethnobotanical experience from AID/R&D/ENR.

## Mitigative Measures

The following mitigation measures will enable USAID/Bolivia and the BOLFOR Project participants to offset, minimize, or avoid any possible adverse environmental effects and to ensure that project activities are carried out in an environmentally sound manner. The measures presented are primarily directed to ensure that forestry and associated project activities are carried out in a manner that, in accord with Section 533(c)(3) of the 1991 Foreign Operations Appropriations Act, maintain the forest's ecological functions and minimize impacts to biological diversity. Note that many of these mitigative measures are based upon the current plans of the BOLFOR project design team and are fully consistent with the project's goals and objectives.

### Mitigative Measures for Currently Specified Project Activities:

1. Prior to the establishment of the BOLFOR Project research plots on the Moira concession, a binding agreement should be reached between the Project, the concessionaire and appropriate public and private authorities (e.g. the Camara Forestal and CDF) that (a) the research plots will be under the full control of the Project during the life of the project, and (b) the BOLFOR silvicultural research practices will not be adopted by the concessionaire until project research determines the conditions under which the ecological sustainability of these practices can be assured. This research should include, but not be limited to, an assessment of the (a) the abundance and distribution of commercial trees of intermediate size classes that would be freed from competition, (b) the abundance and distribution of wildlife populations that might be affected by this practice, (c) the identification of keystone species (e.g. non-commercial trees providing important fruit crops during periods of seasonally low fruit abundance) or habitats (e.g. streamside corridors) that should be fully protected, and (d) studies of the effects of liberation thinning and other forestry practices on biological diversity.
2. The BOLFOR project should investigate the role of natural and anthropogenic fire in the Lomerio and Bajo Paragua forests, and, as appropriate, institute fire control programs at both sites.
3. Project activities at Lomerio should support the training of community members in sustainable forest and wildlife management.
4. The BOLFOR project should support research into the subsistence use of wildlife in the Moira concession and Lomerio community to assess (1) the impact of hunting on prey species populations and (2) the effectiveness of different strategies to reduce hunting to ecologically sustainable levels.
5. BOLFOR project activities involving work with local communities (both at Lomerio and with the seasonal laborers employed by the Moira concession) should make particular efforts to ensure that research is conducted and technical assistance provided in a manner most appropriate for local social conditions. BOLFOR technical staff directly involved with this aspect of the project should therefore receive training in appropriate methods of community participation, particularly Participatory Rural Appraisal.
6. Surface surveys of archeological artifacts, and information on culturally important sites (e.g., sacred lakes, hills, etc.) are required in any areas where the Project may be involved in construction or other activities disturbing existing habitats.
7. Monitoring and evaluation of the ecological impacts of project forest management activities should be carried out in the manner specified in section 5.0.
8. Amendments to this environmental assessment should be carried out in the manner specified in section 6.0.

### Supplementary EAs

Future environmental assessments (technically, amendments to this environmental assessment) should be conducted for any planned project activities that are not explicitly addressed in this EA and that may have significant environmental impacts. This should include, but not be limited to, assessments of the environmental impacts of:

- Project activities that directly or indirectly promote the forestry activities in sites other than the Moira concession or Lomerio community forests or involving silvicultural practices not described in this environmental assessment.
- Project activities that directly or indirectly promote the use of additional timber or non-timber forest products (NTFP's) in the Moira concession, Lomerio community forests or other selected sites. Excluded from these EA's should be applied research conducted to determine ecologically sustainable levels of product harvesting.
- Project activities that directly or indirectly promote ecotourism.

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## **AN ENVIRONMENTAL ASSESSMENT**

### **THE SUSTAINABLE FORESTRY**

### **MANAGEMENT PROJECT**

#### **1.0 INTRODUCTION**

##### **1.1 Purpose and Scope of the Environmental Assessment**

In FY 92 the Environment/Natural Resources Officer of the U.S. Agency for International Development (USAID) Mission in Bolivia carried out an Initial Environmental Examination (IEE) of the Sustainable Forestry Management Project (BOLFOR). A Positive Determination was reached. LAC/DR/E (The Regional Bureau environmental office) concurred with a July 16, 1992 memo (LAC-IEE -92-41). Because this project potentially involves commercial timber extraction in primary forests, the decision is in keeping with Section 533(c)(3)(B) of the FY 91 Foreign Assistance Appropriations Act which places certain restrictions on the use of A.I.D. funds for such purposes.

The goal of the proposed project is to reduce degradation of forest, soil and water resources and help conserve Bolivia's biological diversity. The purpose is to build Bolivian public and private sector capacity to develop and implement programs for sustainable forest use. This will be accomplished through a tightly integrated set of activities including applied research, training, natural forest management demonstrations, value-added enterprises and marketing, and policy analysis and dialogue. If the project is successful, enterprises will implement Forest Management Plans for timber and non-timber forest products meeting national and international sustainability certification standards.

Composition of the EA team and the timing of its activities reflects the collaborative DAP process. During the preparation of a conventional Project Paper the EA team often begins its work once the project design is nearing completion. In the case of Sustainable Forestry Management Project the EA has been conducted parallel with the Project Paper preparation. EA team members have had direct input to the design of the project, particularly in the protection component with its strong emphasis on research and training. EA team members were in the field together with the forester, marketing expert, economist and anthropologist participating in interviews, field observations and lengthy discussions on project design.

The EA Team Leader, Dr. Joshua Dickinson, had sole responsibility for guiding the EA preparation, while the forest ecologist from the contractor team was responsible for both design of the research and training component and contributing to the EA., Dr. Francis Putz, the forest ecologist has a strong familiarity with forestry practices and sustainability certification procedures and therefore was able to provide a strong logical link between the production forester's perspective and the design of research to support realistic impact mitigation measures.

Balancing the contractor contribution were three scientists representing an array of environmental concerns and competencies. They had no vested interest in the outcome of the design other than to assure its environmental soundness. According to the team's Terms of Reference (attached) all EA team members must approve the final product prior to submission. The independent team members included Dr. Peter Frumhoff, an animal ecologist and biodiversity specialist serving as a AAAS Fellow with AID/EID in Washington who had participated in the BOSCOEA EA, Dr. Howard Clark, a plant ecologist serving as the A.I.D. Regional Environmental Advisor for South America and Dr. Jeannine Koshear, a geographer and AAAS Fellow with ethnobotanical experience from AID/R&D/ENR.

As the attached Terms of Reference indicate, a modified programmatic EA is suggested which combines site-specific analyses where activities are anticipated, with guidelines for supplemental EAs when precise locations of forest management pilot sites and the specific forest products to be the focus of project activities have been chosen. This will allow USAID to ensure the environmental soundness of future activity that arise during the "rolling design" of the project.

The EA field review was carried out in Bolivia from 14 March to 27 March 1993. The field review was organized and coordinated by the USAID/Bolivia Environment/Natural Resources Officer, Dr. Michael Yates and conducted by the team identified above.

An informal scoping process included meetings with Government of Bolivia (GOB), USAID/Bolivia, private sector, and non-governmental organization (NGO) representatives, and field interviews were conducted with industrial and indigenous community forest users within two proposed project sites in northeastern Bolivia in the Department of Santa Cruz. Field visits were made to forest harvest sites and intact forest areas during the period of 17-20 March, 1993. Specifically, the team visited intact primary forest (the Ríos Blanco y Negro Wildlife Refuge) and currently logged forest (the Moira timber concession) in the Bajo Paragua region of Santa Cruz, forested areas logged by Chiquitano indigenous communities near Lomerio, Santa Cruz, and sections of the Noel Kempff Mercado National Park near Flor de Oro, Santa Cruz. Overflights of the region provided additional information on current land use and vegetation. Analyses of results based on these field visits, meetings, interviews and a review of existing literature were compiled by the EA team and form the basis for the observations and recommendations presented in this report.

## 1.2 USAID Environmental Policies and Regulations

All AID programs are subject to a clearly defined set of environmental mandates. AID's environmental regulations are modeled on the U.S. National Environmental Policy Act (NEPA), authorized by Congress in 1969, and subsequent guidelines developed by the U.S. Council on Environmental Quality (CEQ). The environmental policy for AID is specified in federal regulations CFR 22, Part 216, dated October 9, 1980. In summary, this legislation requires USAID/Bolivia to:

- Ensure that environmental consequences of AID-financed activities are identified and considered by both AID and the host country prior to a final decision to proceed, and that appropriate environmental safeguards are adopted within the project;
- Assist developing countries in strengthening their capabilities to appreciate and effectively evaluate the potential environmental effects of proposed development strategies and projects, and to select, implement, and manage effective environmental programs;
- Identify all impacts on the environment resulting from AID's actions, including those aspects of the biosphere affecting endangered species (Section 216.5) which are the common and cultural heritage of all humanity; and

• Define environmentally limiting factors which constrain development, and identify and carry out activities that assist in restoring the renewable resource base on which sustained development depends.

Section 533(c)(3) of the 1991 Foreign Operations Appropriations Act prohibits the use of economic assistance funds for "any program, project or activity which would result in any significant loss of tropical forest; or involve commercial timber extraction in primary tropical forest areas". The act requires AID to make certain findings or determinations before supporting any activities that could directly or indirectly affect tropical forest conditions. Specifically, Section 533 requires AID to complete an environmental assessment which would accomplish the following:

- (a) make specific environmental findings and disclose environmental impacts on tropical forests;
- (b) determine whether impacts are of a significant nature;
- (c) determine whether commercial timber extraction will occur in primary tropical forest areas;
- (d) identify potential impacts from proposed activities on biological diversity within the affected area;
- (e) demonstrate that all timber extraction will be conducted according to an environmentally sound management system which maintains the ecological function of the natural forest and minimizes impacts on biological diversity; and
- (f) demonstrate that the activity will contribute to reducing deforestation.

### 1.2.1 Tropical Forest Issues Addressed in the EA

The EA for the Sustainable Forestry Management Project is structured to address the Congressionally mandated concerns outlined in Section 1.2 above and to recommend measures which may need to be included in order to minimize potential adverse environmental impacts of project activities. The EA combines a site-specific focus on two forest management units with an overview that provides the reviewer a perspective on what activities are anticipated and how the project is likely to proceed over the next seven years.

The EA specifically addresses small plot research in tropical forests. It is important to note that none of the major forest management demonstrations and Forest Management Plans described in this EA nor any activities requiring supplementary EAs will take place during the first year of the project. Once the project is established in the field, the team will organize and direct small plot and species specific research, inventories, and feasibility studies. Once discrete packages of information have been developed which show promise as contributions to sustainable forest use, they will be subjected to a supplementary assessment before demonstration, training and dissemination activities begin.

Impacts on tropical forests of small plot research on such topics as tree felling, log extraction, and silvicultural treatments addressed in the EA include:

- \* Impacts on the sustainability of forest resource use
- \* Impacts on plant and animal population

### 1.2.2 Categorical Exclusions

Part 216.2(c) lists several activities which may be categorically excluded from EA requirements. Examples relevant to the BOLFOR project are:

- \* Research affecting the physical environment but limited in scope, carefully controlled and effectively monitored

- \* Controlled experimentation confined to small areas and carefully monitored
- \* Training and technical assistance except when the environment is affected as in the case of the construction of facilities

Because this project will directly and indirectly affect the tropical forest, it has been determined that this EA will address small scale research and experimentation. Supplementary EAs will explicitly address training, demonstration and technical assistance to forest users who will be designing and implementing sustainable Forest Management Plans with project assistance.

### 1.3 The Sustainable Forestry Management Project

#### Goal:

The goal of the proposed project is to reduce degradation of forest, soil and water resources and help conserve Bolivia's biological diversity.

#### Purpose:

The purpose is to build Bolivian public and private sector capacity to develop and implement programs for sustainable forest use. This will be accomplished through a tightly integrated set of activities including applied research, training, natural forest management demonstrations, value-added enterprises and marketing, and policy analysis and dialogue.

If the purpose stated above is achieved, the majority of the forests of Bolivia will be under legally defined and internationally certified site-specific management plans, either for the forest unit as a whole or for specific products. Progress will be measured by the establishment of commercial scale models of sustainable use based on research results.

Approximately ten percent of the national territory of Bolivia has been set aside for parks and protected areas. FONAMA, SENMA and MACA, as well as the national and international conservation community, recognize that preservation of the diversity of ecosystems and species extends to the other ninety percent of the national territory as well. This perspective is particularly applicable in Bolivia where nearly half the national territory is forested. The perspective is embodied in the implementing regulations of the "Pausa Ecológica". Some 22 million hectares are currently under forest concession for the extraction of timber with overlapping concessions in some areas for products such as palmito, Brazil nut and rubber. It is the challenging premise of this project that sustainable management of lands suitable for forestry will result in:

- \* The maintenance of a flow of timber and non-timber forest products competitive with returns from conversion of the land to other uses
- \* The maintenance of a significant amount of biological diversity, ecosystem structure and other values of importance to society

**Caveat:** A conditionality on the sustainability of forest management from an ecological and social perspective will be enforced adherence to a combination of national and international certification requirements. Why this caveat? According to the 1992 World Bank Forest Sector Review, trees and wood prices tend to increase slowly, while real interest rates in Bolivia have been around 15-20 percent. As long as investing elsewhere is more attractive than allowing trees to grow, rapid depletion of marketable timber will continue unless constraints are enforced.

Site selection as a focus for the project design was based on a review of six candidate sites described by the Centro de Datos para la Conservación (CDC). The sites evaluated were the Alto Madidi, Bosque Chimanes, Manuripi Heath, Bajo Paragua, Carrasco/Isiboro Secure, and the experimental forests of the Universidad Autónoma Gabriel René Moreno. After reviewing the information provided by CDC the project team made up of representatives from FONAMA, SENMA, MACA, CDC, USAID, PL-480 and the Chemonics Consortium selected the Bajo Paragua in the Department of Santa Cruz as the project's initial comprehensive pilot site. Subsequent to the screening process, a second site in northeastern Santa Cruz Department was added. This was Lomerio, an area of dry forest where the Chiquitano indigenous community has some 30,000 ha under management and has expressed interest in receiving training and technical assistance under BOLFOR.

Choice of a specific geographic area does not preclude the choice of other sites at later date or the implementation of specific, targeted activities (e.g. applied research) at other sites early in the project. This site specific focus will allow the EA to explore in greater detail the potential impacts of project activities. Lessons learned during this process will help the implementation team to more precisely define subsequent assessment requirements as project activities are replicated or expanded into other areas of the Bolivian Oriente.

By choosing the two sites the possibility of analyzing others is constrained. However, the two sites are representative of a broad range of conditions. The sites offer the following range of conditions:

<u>Moirá</u>	<u>Lomerio</u>
Large concessionaire	Organized indigenous community
Capital intensive	More labor intensive
Subtropical moist forest	Subtropical dry forest
Flat, soils from sandstone	Rolling, soils from granite
Fauna sporadically exploited	Fauna under constant pressure
Isolated from settlement	Amidst 32 settlements
600 km from Santa Cruz	<200 km from Santa Cruz

The sites are similar in that they are both on the Brazilian Shield and exhibit related soil/topographic constraints on commercial agricultural conversion. Both forests have been high-graded and subjected to sporadic burning. In this sense the forests are representative of millions of hectares of forest in Santa Cruz Department that are in need of ecological and economic rehabilitation. There is a real danger that such decapitalized forests will become eventual targets for conversion. These Pre-Cambrian shield forests do not represent forests found on better soils and under more humid conditions of the Andean front or Quaternary lowlands further east and north. Neither site represents "primary" forest (undisturbed, climax, virgin or primeval) in the Section 533(c)(3) sense. If the forests that more closely fit the primary forest conception are to be saved from the currently operative process of degradation, the project will need to establish a demonstration site in such forest.

### 1.3.1 Project Activities

The primary and supporting project activities listed below are described in detail in the Project Paper. The primary project activities include:

- \* Natural forest management
- \* Value-added enterprise development
- \* Marketing of timber and non-timber forest products

- \* Monitoring and evaluation

Supporting project activities include:

- \* Applied research
- \* Training and information dissemination
- \* Policy analysis and dialogue

In a project where capacity building plays a major role, activities involving Bolivian students, professionals and field technicians in research and training takes on major importance.

Note: Several of the activities mentioned above are subject to Environmental Evaluation as part of the Project Paper and later in EA supplements when the activities are defined. The secondary activities (research, training and policy analysis) are normally categorically excluded from EA consideration, unless, as in the case of training in silvicultural methods, they may contribute to extraction of products from primary forests (see Section 1.2.2 for discussion of why research is included as part of this EA. These secondary activities have been designed to contribute to mitigation of environmental impacts associated with the primary activities of the project.

The activities below are particularly relevant to this or anticipated supplemental EAs.

Research and Training - So little is known about Bolivian forest ecology and management that it would be fruitless to recommend any but the most obvious changes in current forest management practices (e.g., directional felling to reduce logging damage) until the appropriate studies have been conducted. Although there are relevant data from other parts of the tropics, silvicultural techniques need to be thoroughly tested in Bajo Paragua and other sites before recommendations can be made in good conscience. This is exactly the goal of the BOLFOR project.

The dearth of trained Bolivian researchers necessitates combining research and training activities. Building the capacity to clearly identify environmental and social problems associated with forest management, to design and implement appropriate research projects, to analyze the resulting data, and to disseminate the results will together represent long-lasting contributions to the cause of forest conservation and sustainable use in Bolivia. Training will also be provided for the technical foresters, forest guards, and forest laborers (e.g., chainsaw operators) who are actually responsible for the well-being of managed forests. To some extent the training of these practical foresters will depend on the results of research supported by the project.

To clarify the types of research needed to provide an ecologically-sound basis for forest management in Bolivia, examples of fairly specific research projects are outlined below. To a great extent, however, the exact investigations needed will depend on the result of the initial studies; this is in keeping with the "rolling design" of the BOLFOR project.

Forest Management - During the design phase the team examined the management practices in parts of two forest operations. First was the 150,000 hectare Moira concession in the Bajo Paragua Production Forest Reserve in northern Santa Cruz. The concession has been under exploitation primarily for mahogany (*Swietenia*), tropical oak (*Amburana*) and cedar (*Cedrela*) since the establishment of a sawmill in 1983 and a veneer slicer in 1988. The overall status of the forest resource was observed, both from the air and on the ground. The second was the Lomerio community forest claimed by the Chiquitano indigenous group. They have a sawmill and exploit a number of the same species as Moira.

Note: Supplemental EAs will be prepared as needed for (a) commercial palmito harvesting in the Bajo Paragua if preliminary research indicates that this resource can be extracted sustainably, and (b) Chiquitano community forest management for timber and non-timber forest products in Lomerio south of Bajo Paragua. In both cases the approaches to environmental assessment and resource management are very similar.

Elements of the anticipated forest management activity include:

- \* Applied research - Forest areas of less than a hectare are chosen for the purpose of testing hypotheses concerning proper management practices. Typical activities include measurement and marking of trees for cutting, trimming of vines, marking of advanced regeneration of valuable species to assure damage is minimized during felling and extraction, directional felling, and liberation thinning.

- \* Pilot area management - Commercial scale interventions in the forest to extract timber and other products clearly require assessment. A thorough knowledge of possible management interventions that would contribute substantially to both sustainability and profitability must be gained before engaging in commercial scale pilot extraction activities. Prior to initiating interventions, a supplementary EA will address the forest management plan as designed. Of overall concern in supplemental EAs are activities that involve significant human/machine intrusion into the forest and activities that significantly affect flora and fauna, species richness and biological diversity, modify ecosystem structure and function and/or degrade soil and water resources. A brief profile of anticipated activities follows (see greater detail in Section 3.0). The project would first reach an accord with the GOB and the concession holder to allow the team to direct the full range of logging activities in a discrete block of the concession - from inventory to access road closure. Project directed logging conducted according to accepted certification guidelines will be compared with (a) parallel or sequential uncontrolled logging by the concessionaire on a similar site, and (b) a unlogged control area of similar size and ecological characteristics. This comparison would involve essentially the same environmental, social and financial/economic assessment as being carried out in support of the Project Paper and EA. The primary difference being the greater intensity of effort over a longer period of time with periodic follow up measurements. Closely linked will be intensive training and research activities.

This EA assumes that pilot areas in the Moira concession and the Lomerio community are chosen that are substantially similar to the areas where extraction was studied in March of 1993.

Value-Added Enterprise Development and International Marketing - It is a basic premise of the project that the greater the financial return that Bolivians are able to realize from the forest resources the greater will be the incentive to maintain forest cover. Given the high cost of transportation, processing for export markets offers an effective means of adding value to timber and non-timber forest products assuming that certification and environmental regulations are enforced. Otherwise, mining can also occur. Value-added processing is closely linked with identifying, satisfying and expanding international markets. Given that only a few woods such as mahogany are valuable enough as logs or sawn wood to pay their freight, the project assumes that any expansion in the number of species used will also involve value added processing.

The potential benefits of an integrated processing and marketing effort include:

- \* Increased participation of small to medium scale enterprises
- \* Significantly increased employment per dollar of sales

- \* Increased revenue per cubic meter of wood or other products harvested

The successful implementation of the value-added/marketing component will impact the forest resource as a whole through increased demand, either overall or for selected species. It would be possible to attribute demands for a particular species of forest plant to the geographic range within which it is exploited, but no closer. Thorough studies will be made of each candidate species to determine the potential impact of its extraction on fauna and ecosystem structure. Minimization of impact is predicated in part upon achievement of ecological and economic sustainability in forest use through enforcement of national laws and/or compliance with international certification requirements.

Since the demands of value-added enterprises cannot be defined at this time, this EA will provide general guidance for environmental assessment during project implementation in Section 6.0. Indirect impacts are discussed in Section 3.2.4.

### 1.3.2 Project Outcomes Anticipated

The project expects to reduce both the conversion of forests to other uses and the degradation of standing forests and their associated soil and water resources. These overall benefits will be directly or indirectly achieved through building Bolivian public and private sector capacity to manage and use forest resources sustainably. The following are some of the expected specific outcomes by major project component:

#### Research -

- \* A capability to predict actual and potential timber stocking based on knowledge of the soil, climate and ecological process interactions that affect the distribution and productivity of particular species assemblages
- \* A better understanding of how forest product management interventions affect biological diversity and how negative impacts can be minimized
- \* An understanding of site-specific management interventions that result in significantly higher sustained production of forest products with reduced secondary impacts on forest ecosystems
- \* A better understanding of the origin and role of fire in humid tropical forest as well as the ecological, economic and management implications thereof

#### Training and dissemination -

- \* A greater awareness on the part of local people, politicians and decision makers of the economic value and ecological importance of tropical forests
- \* A cadre of foresters and related professionals trained at the Ingeniero or Masters level who will meet future needs in sustainable forestry
- \* Mid-career foresters, biologists, social scientists and economists in government and industry trained through in-service courses to regulate and manage projects in sustainable forest management
- \* Technicians, tractor drivers and chainsaw operators trained in field application of sustainable forest management practices

#### Natural forest management -

- \* Once appropriate strategies are identified through applied research and disseminated via commercial scale demonstrations and training - concessionaires will implement Forest Management Plans for timber and non-timber forest products meeting national and international sustainability certification standards
- \* Reduced rates of forest conversion to other uses on lands best suited for forestry under Bolivian land capability classification
- \* Reduced forest degradation by destructive logging practices through adherence to low-impact guidelines

#### Marketing -

- \* More diversified enterprises adding value to a wider range of timber and non-timber forest products
- \* A significant increase in the value of forest products exported from sustainably managed forests over the life of the project.

#### Policy analysis -

- \* A more open and effective policy dialogue among government institutions, the forest products industry, NGOs, indigenous groups, and the donor community concerning sustainable forest management
- \* Effective support to implementation of policies contributing to sustainable forest management

#### 1.3.3 Sustainability

The vagueness of the concept of "sustainability" and its multiple definitions, make the issue difficult and controversial. For the purposes of this EA, ecological sustainability and sustainability of timber harvest will be explicitly distinguished.

Ecological sustainability analysis is complex and the criteria upon which such analyses are based are not widely accepted. The criterion of biodiversity maintenance are discussed in Section 3.1.2. Briefly, it is not at all clear that the maintenance of species richness should be the major criterion upon which sustainability is judged; stands with equally long lists of species could be dramatically different in structure, composition, and ecosystem function. The other components of biodiversity, genetic and ecosystem diversity, are equally problematic and difficult to measure. The spatial and temporal scales at which sustainability should be assessed are also not clear. Should assessment be by stand (e.g., 100-1000 ha), by concession, or by forest reserve? At what population density should species be considered to have suffered irreparable damage? Populations of some long-lived species remain in managed areas but produce no young; over what time scale should population viability be assessed?

Ecological sustainability depends on the continued presence of all the species responsible for future forest ecosystem function. So little is known about the biology of even the most important commercial timber species in Bolivia that loss of any species of plant or animal should be avoided. Particularly important are the pollinators, seed dispersal agents, and the associated plant species upon which populations of these animals depend. Swietenia, Cedrela and Amburana have wind dispersed seeds and apparently are pollinated by insects, making them unlikely to be effected

by over-hunting. Logging, hunting, and forest fragmentation by roads, however, may result in the proliferation of small mammals that prey on seeds of these species insofar as hunting generally decreases populations of mammalian carnivores. For the other tree species for which Bolivian forest will likely be managed, even less information is available. Some have fleshy and presumably animal dispersed seeds (e.g., Guarea and Calophyllum). Others (e.g., Cariniana and Tabebuia) have large flowers that are probably pollinated by large insects, birds, bats, or non-volant mammals. Even the highly selective logging currently practices in much of lowland Bolivia could have negative impacts on population stability of these species.

From the perspective of nutrient dynamics, forest management practices are not sustainable if they call for removal of greater quantities of nutrients than are released from weathering of soil parent materials or are deposited in rainfall, dust, and etc. over some "reasonable" period of time. Because wood generally has a low nutrient concentration and because logging intensities in Bolivia are light current harvesting practices are unlikely to result in biogeochemical sustainability. Calls for intensification of logging, however, need to be regarded in light of the resulting negative effects on nutrient budgets on what appear to be extremely poor soils.

#### 1.3.4 Eco-certification

To the extent possible the BOLFOR project will use market forces to motivate change from destructive to less destructive timber and non-timber forest product harvesting practices. One already significant and growing market force springs from worldwide concern for the continued existence of natural forests and the continued supply of forest products. This concern is being manifested in an increasing number of tropical timber boycotts and in the emerging "green" consumerism. The threat that their forest products will not have access to markets in environmentally concerned parts of the world is one reason for the widespread interest of Bolivian forest product exporters in "eco-certification". Pronouncements by the Bolivian government that all timber will be harvested sustainably before 1995 (Pausa Ecológica) and the International Timber Trade Organization's similar worldwide target for the year 2000 are contributing to the interest in eco-certification of Bolivian timber and timber products. Finally, at least some members of the Cámara Nacional Forestal and other forest managers see eco-certification as an attainable goal. Eco-certification also serves as an organizational theme for the BOLFOR project insofar as it incorporates forest protection, sustainable forest use, monitoring of the effects of forest management, and marketing of forest products.

Eco-certification programs are still developing but there is general consensus about the basic principles and criteria for forest management. Attainment of this consensus is in part due to the activities of the Forest Stewardship Council (FSC), an organization dedicated to monitoring and accrediting forestry certification programs worldwide. The principles of forest management endorsed and promoted by FSC and the eco-certification organizations that it represents are as follows:

#### FOREST STEWARDSHIP COUNCIL PRINCIPLES OF FOREST MANAGEMENT (Draft VI, October 1992)

**Principle 1. Management Plan:** A written management plan must exist which clearly states management objectives for each forest, the means for achieving these objectives, and provides for responses to changing ecological, social and economic circumstances.

**Principle 2. Forest Security:** The ownership of the forest must be clearly defined and documented, and management areas dedicated by the owners to permanent forest cover.

**Principle 3. Social and Economic Benefits:** Participating parties should receive an equitable share of the benefits arising from forest production activities.

**Principle 4. Local Rights:** The legal and/or customary rights of indigenous peoples and other long-settled forest-dependent communities affected by forestry activities must be protected, and forest management planning and implementation must provide for full and informed consent in relation to activities that affect them.

**Principle 5. Environmental Impact:** Forest management activities must have minimal adverse environmental impact in terms of wildlife, biodiversity, water resources, soils, and non-timber and timber resources.

**Principle 6. Sustained Yield:** Harvesting rates of forest products must be sustainable in the long-term future.

**Principle 7. Maximizing the Forest's Economic Potential:** Forest management should take into account the full range of forest products (timber and non-timber), and forest functions and services, and should maximize local value-added processing.

**Principle 8. True Costs:** The cost of forest products should reflect the full and true costs of forest management and production.

**Principle 9. Appropriate Consumption:** Forest production should encourage judicious and efficient use of forest products and timber species.

**Principle 10. Forest Plantation:** Plantations should not replace natural forest; they should explicitly augment, complement, and reduce pressures on existing natural forests.

**Principle 11. Chain of Custody:** The original sources and subsequent steps in the processing and supply chain must be documented to allow accurate product tracing.

The concordance between the FSC certification principles and the central theme of the BOLFOR project is nearly complete. The more detailed criteria and compliance guidelines of the certifying groups (e.g., Rainforest Alliance, or Green Cross Certification Company) will influence project-related forest management activities. Working towards the goal of eco-certification provides an independent evaluation of project performance and will financially benefit those companies, indigenous organizations, and other forest holders who satisfy the stated criteria and become eco-certified. While there are a number of fairly substantial changes in forest use practices that need to be made before eco-certification is a possibility, Bolivian forest managers are actually closer to this goal than their colleagues in many other tropical countries. To lead the world in compliance in ecologically and socially-sound natural forest management would be a boon to Bolivian forest and forest product industries and would unite environmentalists and industrialists in a common goal.

### 1.3.5 Implementation Schedule

**Phase I (First 12 to 18 Months)** - The project implementation will begin in July of 1993, at the peak of the dry season timber harvesting period. It can be assumed that the first two months will be largely spent setting up offices, establishing working relations with counterparts, and assembling supplies and equipment. Once the logistics of settling in and team formation is complete, the critical process of institutional coordination will begin. For example, CIMAR, the Centro de Investigación y Manejo de Recursos Naturales, is expected to play a key role in coordinating research and training. This EA covers all anticipated activities during the first 18 months.\*

**Research** - Data gathering in support of hypothesis testing for priority topics will begin during the first two to four months and continue into the second year. Examples include:

- \* Measurement of the impact on plant and animal diversity and ecosystem structure of existing

palmito, babassu and timber harvesting in the Bajo Paragua and Lomerio.

- \* Baseline data gathering on flora and fauna and key ecosystem parameters can begin early in collaboration with the herbaria, the WCS project and other institutions.
- \* Sites for field testing of forest management strategies for timber and non-timber products can be identified. Data on plant, animal and system impacts will be gathered to compare with controls.
- \* In collaboration with the marketing group, new non-timber forest products with a potential in the market can be identified for research into their regeneration and the impact of their removal on the rest of the ecosystem.

**Training** - Much of the training during Phase I will involve training in research methodology and followed by learning while carrying out research. Research leading to the Ingeniero degree or its equivalent will be focused on problems relevant to the project under close supervision of national and visiting experts.

By the end of six months the first contingent of Masters degree candidates will have been awarded fellowships for study abroad. These first BOLFOR Fellows will return in 12 to 18 months to begin thesis research on problems identified by the project.

Given that baseline data gathering, preliminary research and non site-specific training will occupy much of the first year, little supplementary EA activity is expected during this period.

**Note:** Much of the initial research and training will focus on the protection side of the project to assure a higher probability of problem identification prior to investment of funds and credibility in forest management demonstrations. By the end of the first 18 months research should be well underway leading to the creation of demonstration site programs and training modules.

**Phase II (18 - 36 months)** - The most dramatic addition to project activities during Phase II will be the launching of demonstration and training activities.

**Research** - Research begun during Phase I will continue and new work initiated as needs for information are identified. Ecological, economic and social feasibility studies for various extractive activities and ecotourism will be carried out. Because processes and cycles in a tropical forest ecosystem are complex and may have long time constants, much of the research will continue throughout the project and hopefully carried on beyond. The capacity of Bolivian institutions to carry out this research should be enhanced by the return flow of trained professional returning from graduate studies abroad. Examples include growth and yield measures, succession following silvicultural treatments, changes in faunal composition and species regeneration studies. These activities will become part of the overall Monitoring and Evaluation program. Feedback from ongoing research and monitoring will be incorporated in the technical material being disseminated.

Toward the end of Phase II it is expected that activities being carried out in Santa Cruz Department will be replicated in other parts of the Bolivian Oriente. This will necessitate replication of some protection as well as production-oriented research in new ecological settings. Support for some of this research will begin early in the project, for example - continuing support for the work underway in the Bosque Chimanes.

**Demonstration and training** - Supplementary EAs will be performed on individual, or coherently clustered, demonstration and training activities. Early activities will emphasize discrete themes (directional felling, extraction, etc.) certain to contribute lower impact logging. However, by the end of Phase II it is anticipated that commercial

scale demonstrations of logging and non-timber forest product extraction with cooperating forest managers will be underway. These commercial scale activities will be subjected to in-depth EA treatment.

Demonstrations will be complemented by an integrated sustainable forestry curriculum. Each module will be free standing, but will contribute to an integrated package. Modules will be designed to be conducted in the field with an emphasis on learning by doing. The first field testing of the training module will be filmed by a professional videographer and a 45 minute video created to be used as an integral part of future courses and as a training film available to sustainable forestry teachers and practitioners.

The core curriculum can be divided into three component parts each with its set of training modules. They are listed below:

#### Tropical Forest Management

- \* Forest inventory and mensuration techniques
- \* Research methods in forestry and forest ecology
- \* Selection of management strategies
- \* Timber felling and extraction road construction
- \* Preparation of a forest management plan
- \* Assessment and monitoring for certification and EAs

#### Forest Product Utilization

- \* Milling - chainsaw, portable and conventional
- \* Wood technology and wood working
- \* Drying and finish milling
- \* Value added processing techniques

#### Forest Product Marketing

- \* Marketing organization and quality control
- \* Matching of markets with products and skills
- \* Business management

Phase III (36 months to End of Project) - By the beginning of Phase III the project should have a good idea of what sustainable forest management looks like under specific site conditions in Bolivia. By this time the Pausa Ecológica and European Community deadlines for certification of sustainability of management will have passed. A broad

spectrum of the forest products industry should be ready to accept and apply sustainable management techniques.

Research - Much of the research will be dedicated to refinement of knowledge about sustainable management and continued monitoring of activities.

Demonstration and training - Wide dissemination and replication of sustainable forest management will be the primary objective of Phase III. Achievement of success will depend on major participation of Bolivians in the process. Training of trainers will be necessary.

## **2.0 THE AFFECTED ENVIRONMENT**

### **2.1 General Description**

**Bajo Paragua** - The 270,000 km<sup>2</sup> Bajo Paragua region of northern Santa Cruz Department encompasses the Noel Kempff Mercado National Park on the east, the Bajo Paragua Production Forestry Reserve (including the 150,000 ha Moira concession) and the Rios Blanco y Negro Wildlife Reserve on the west. All three units are bordered on the south by the 15th parallel, south latitude. The entire area lies within the sub-tropical humid life zone. The annual rainfall is probably 1000-1500 mm decreasing north to south, with a mean annual temperature of 23-24°C. There is a marked dry season between May and October. No direct climatological data are available for the Bajo Paragua. The Forest Reserve and concession are below 500 m elevation.

This area of initial project focus represents a strikingly different environment from much of eastern Bolivia. The dominant feature is the Brazilian Shield with its ancient sandstones and granitic outcrops. Millions of years of weathering of rock that is poor in nutrients to begin with has given rise to a relatively flat landscape with nutrient poor and well to excessively drained soils, reddish to gray in color in the uplands, with clay pans underlying the wetland areas. Black-water rivers in the area are another indicator of extreme soil and water acidity, low cation-exchange capacity, and extremely low soil fertility. The existing cover is dominated by humid evergreen and semi-deciduous forests, with another 20 percent of the area in forested and herbaceous wetlands, shrubby termite mound savannas and bare granite outcrops. Due to the flat to rolling topography and well drained soils, logging concession roads are trafficable even in wet weather and cause relatively little erosion.

In regards to climate, averages tell only part of the story. Extreme conditions sporadically prevail - cold Antarctic air masses occasionally penetrate well into the tropics, El Niño related periods of drought and excessive rainfall occur as well as winds in excess of 100 km/hr. The extreme events may very well be correlated with the frequent incidence of fire. Periodic fires appear to be important components determining the structure and composition of these ecosystems, with verbal reports given to us of massive forest fires throughout the region in 1942, and more local fires in other years, some (at least) caused by lightning. These forests generally have been logged previously for mahogany (old sawn stumps are occasionally visible), which may increase susceptibility to fire through seemingly minor changes in humidity within the forests. It is essential for the Project to determine the fire history of the area, and the relative impacts of fire on commercially important species, and the impacts of Project forest management recommendations on increasing the likelihood of fire, in addition to the impacts of fire on all other ecosystem components.

Human occupancy of the shield area has been equally sporadic, leaving only ambiguous traces on the landscape. Personnel of the Moira concession mentioned the occurrence of ceramic artifacts, some large enough to be burial urns, and richly decorated vessels, in the area. In the Ríos Blanco y Negro Reserve, petroglyphs and ceramic artifacts have been found at Laguna Pajara, near Río Blanco. The project area was apparently peripheral to the Jesuit influence of the 17th and 18th centuries. Strings of place names marking forgotten towns of the rubber boom give the illusion of human presence in northeastern Santa Cruz. The climatic and human history is sketchily recorded at best, even during this century. One can only extrapolate from relatively distant places such as Santa Cruz and Trinidad. The rather scraggly forest that one finds today on the shield and specifically in the Moira

concession, reflects not only the logging since 1983, but also interaction of vegetation with poor soil, climatic extremes and fire during the last 200 years.

**Lomerio** - Lomerio refers to the area traditionally inhabited by over thirty communities of the Chiquitano people encompassing some 130,000 ha southeast of Concepción in Ñuflo de Chavez Province of the Department of Santa Cruz (16N, 62W). About 40,000 ha of this area has been proposed for a forestry concession.

The Lomerio area is also part of the Brazilian Shield formation with Pre-Cambrian granite/gneiss outcrops combined with metamorphics and some tertiary sediments. The topography and soil of the region vary with its geology. Near Concepción is a nearly flat plain of Tertiary sediments. East of Concepción is a more rolling plain; where soils have developed, they are derived from Precambrian Shield granite and gneiss. South and West of Concepción the geology is more complex with plains on Tertiary sediments and undulating areas on Pre-Cambrian granites. For the most part the soils are well drained and nutrient poor. Large granitic outcrops (Inselbergs) occur throughout the area but are particularly abundant in the southern portion of the area near San Antonio de Lomerio.

Based on data collected at the Concepcion airport over the period of 1955-1990, the area receives an average of 1129 mm/year of precipitation, most of which falls during the September through April rainy season. The months of June, July, and August each receive less than 40 mm of precipitation. The maximum and minimum temperatures recorded were 38.1 and 3.0 C, respectively but the average temperature during the coldest months is 16.7 C.

## 2.2 Flora

**Bajo Paragua** - The Moira forestry concession, including other concessions now controlled by this group through purchase of wood processing plants and equipment, adjoins the Rios Blanco y Negro Wildlife Reserve. Floristic, faunistic, forestry and anthropological/sociological inventories and related studies are now being carried out in the 1,400,000 ha of this Wildlife Reserve, with funding from the PL-480 program of USAID/Bolivia and other sources. The  $\pm$  150,000 ha in the expanded Moira concession lies on the 15th parallel south latitude between the Noel Kempff Mercado Park and the Rios Blanco y Negro Wildlife Reserve.

Before the BOLFOP Project can establish a well-designed monitoring system to determine impacts of Project activities, studies similar to those being carried out in the Wildlife Reserve will be necessary to determine the baseline conditions of biological and non-biological ecosystem components that could be affected directly by Project activities and indirectly by changes in forest management practices encouraged by the Project. To rationally plan forest management programs, it is necessary to map the forest types and the distribution of commercially important species in the concession area, and in any other areas where the Project may work. Initial inventories should concentrate on forest communities containing mahogany (mara, *Swietenia macrophylla*), as Project research and demonstration activities will concentrate in these areas. The forestry and environmental/biological data are complementary, and both are necessary for successful implementation of the Project.

The terrain and biological communities of the wildlife reserve are apparently similar to much of the Moira concession. Because we know of no detailed studies of ecosystems and communities in the concession, the following information from the Wildlife Reserve will give some indication of the diversity of ecosystems and taxa in the Moira concession. Our two days of observations in limited parts of the concession were only sufficient to give general impressions of parts of the area. The Reserve information is taken primarily from locally established sources. This information is summarized in the following paragraphs.

The Rios Blanco y Negro Reserve is on the westernmost extension of the Pre-Cambrian Brazilian Shield (or Eastern Bolivian Shield). Surfaces in the extreme west and north of the Reserve are derived from Quaternary fluvio-lacustrine deposits, while areas close to watercourses are overlaid by the later deposits of current drainage

systems. These surfaces are covered by latosols and duricrusts, which support distinctive vegetative cover visible in the commercial false-color LANDSAT images (O'Connor et al. 1987). In general, a thick, lateritic soil has developed in flat regions, and supports dense evergreen forest. Low scrub and brush grow on sandy soils and around the isolated bedrock outcroppings ("lajas"), while swamplands, arising from poor drainage through clay alluvium, occur in low-lying areas.

Detailed floristic studies are ongoing in the Reserve, using transects (500 x 2 m) and permanent 1 ha plots (line intersects in savanna areas), but most collections have not been identified to species as yet. Species new for Bolivia, or new for science, are being found. It is probable that endangered and rare taxa are relatively abundant in this floristically unique area.

In 34 forest inventory plots (500 x 20 m), no mahogany (mara, *Swietenia macrophylla*) was found, apparently due to prior logging in the area, and perhaps other factors (e.g., fire). Mahogany and cedro (*Cedrela* sp.) were only found in the southern part of the Reserve and in the Río San Martín zone. These species were in clustered distributions, forming mosaics in high and well-drained sites, although some isolated individuals were found.

Evergreen forest grows on high, well-drained soils underlain directly by the Brazilian Shield, with non-forested outcroppings of Shield granitics. This is the dominant vegetation type in the Reserve, growing in the thick soils of the peneplain. A marked difference in vegetational composition was noted between terra firme forest east and west of the Yacundá river. To the west, a dominance of the tree *Pourouma*, with herbaceous coverage of *Erythrochiton*, was present, while east of the Yacundá, in the larger part of the reserve, *Erythrochiton* was more or less absent, and replaced as the dominant herb by *Costus* and *Heliconia*. Common tree genera east of the Yacundá were *Chorisia*, *Cedrella*, *Zanthoxylum*, *Tabebuia*, and *Hymenaea*, and the palms *Maximiliana* and *Astrocaryum*. The vegetational differences in terra firme forest composition were, to some extent, reflected in differences in the bird species composition.

~~Two general forest types are distinguished in the Reserve: those on the Brazilian Shield, and those in the alluvial plains in the western parts of the Reserve.~~

In the Shield area, on lateritic soils with clay in depressions, the following five subtypes are distinguished:

a. Shield:

conspicuous: *Pourouma* and *Erythrochiton*;

upper stratum: *Ficus*, *Ceiba pentandra*, *Hymenaea*, *Aspidosperma*, *Cavanillesia*;

secondary stratum: *Inga*, *Pseudolmedia*, *Pourouma*.

b. valleys crossing shield (higher diversity than surrounding forests):

characterized by palms *Euterpe*, *Socratea*, *Astrocaryum*, *Mauritia*.

important timber species: *Cariniana*, *Calicophyllum spruceanum*, *Cordia*, *Schizolobium parahyba*.

c. high forest on peneplain; <100 individuals/ha are >20cm DBH; lateritic, with local clays, in depressions are banks of sand:

economically important species: *Swietenia macrophylla* and *Cedrela*

other species: *Ficus*, *Terminalia*, *Cariniana*, *Hymenaea*

secondary stratum: *Inga*, Apocynaceae, *Pourouma*;

understory: dense lianas.

d. high floodplain forests; seasonally inundated up to 4 months; 2-3 m high, impenetrable underbrush of lianas, with *Bactris* and bamboos:

economically important species: *Cariniana*, *Ficus*, *Terminalia*, *Calicophyllum brasiliense*.

e. ridge and slope forest; crowns to 30 m high; primarily deciduous; twisted trunks in upper slopes; evergreen with a few deciduous on lower slopes, ridges have shrubs and spiny lianas; soils at foot of slopes are deep and humid, ridgetops have granitic outcrops:

characteristic taxa: *Caesalpinia*, *Tabebuia*, *Anadenanthera macrocarpa*, *Jacaranda*, *Hymenea*

Two types, flooded and non-flooded forests, are distinguished on the alluvial floodplains of water courses, both on clay or sandy clay soils.

a. The non-inundated alluvial forests, on heavy clay soils, include several species of commercial importance, including *Hura crepitans*, *Terminalia* spp., *Calophyllum brasiliense*, *Cordia*, and *Cariniana*.

b. The inundated alluvial and swamp forests are flooded 3-4 months per year; soils are clayey, with deficient drainage. Characteristic microreliefs are present in many of these areas, with irregular ridges or hillocks 30-50 cm high, 30-100 cm across.

The dominant tree species of commercial importance is *Hura crepitans*.

There are minor occurrences of savannas, marshes, palm-dominated forests, and distinctive aquatic plant communities. While not of commercial forestry importance, these are critical habitats for many species of plants and animals.

Lomerio - The region has a rich mosaic of vegetation associations of the Subtropical Dry Forest representing a transition zone between Amazonian and Chaco regions and the influence of different soils, topographic positions, and land use histories. Savannas predominate on severely drained upland soils throughout the region. Savanna-like vegetation also occurs in valleys subjected to seasonal inundation. The granite outcrops have their own peculiar vegetation, dominated by ground bromeliads and other herbaceous plants. The most likely locations of endemic species are on the granite outcrops. Semi-deciduous forest in the region develops on the more mesic sites where soil has accumulated and is transitional between the evergreen forests of the Amazon and the deciduous forests of the Chaco region. The canopy of this forest is fairly low, ranging from 12-18 m with a dense understory to about 6 m. Frequent canopy tree species include *Astronium urundeuva*, *Anadenanthera macrocarpa*, *Caesalpinia* sp., *Cordia* sp., *Amburana cearensis*, *Schinopsis*, *Tabebuia chrysantha*, *T. impetiginosa*, *Pterocarpus*, *Phyllostylum*, *Peltogyne confertifolia*, *Centrolobium* spp., and *Terminalia amazonica*. In the understory there are occasional extensive colonies of bromeliads (*Pseudoananas paniculata*). Northwest of Concepción is an area dominated the palm *Orbignya phalerata* ("cusi" or "babassu"). More detailed description of the vegetation can be found in Killeen et al (1990). There are obvious signs of fire and wind damage but apparently there are no data on either type of perturbation. Scattered through the region are small patches of agricultural land and pastures, both active and abandoned. Some of the forest shows signs of having developed in abandoned agricultural clearings. There are several small streams in the area and herb-dominated zones of seasonal inundation, but no large permanent water bodies.

## 2.3 Fauna

### 2.3.1 Faunal inventory

Bajo Paragua - Faunal inventories do not currently exist for the Bajo Paragua project site, the Moira concession. However, the site is contiguous with and ecologically quite similar to the Ríos Blanco y Negro Wildlife Refuge where the vertebrate fauna has been recently inventoried (FAN and WCI, 1993). It is also adjacent to the Noel Kempff Mercado National Park, where the mammals and birds have been surveyed (Wallace and Painter, 1992). We therefore base our discussion of the project site fauna on these inventories, supplemented by our brief field

observations and discussions with Dr. Andrew Taber, Wildlife Conservation Society. It is important to emphasize, however, that the diversity and density of fauna in the project site may differ substantially from these inventoried locations, for two primary reasons. First, a history of subsistence hunting and timber harvesting in the Moira concession has likely had a substantial though undocumented effect on wildlife abundance, distribution and diversity. Second, much of the forest habitat of Noel Kempff Mercado National Park is ecologically distinct from the forests within the Moira concession and likely contains a somewhat distinct fauna. Nonetheless, there is undoubtedly some species overlap and individuals of some species may move regularly between the park and project site.

The Ríos Blanco y Negro Wildlife Reserve and the Noel Kempff Mercado National Park contain highly diverse assemblages of mammals and birds. 70 species of mammals and 396 species of birds (329 residents and 67 migrants) have thus far been identified within the Reserve and 44 species of mammals and 232 species of birds have been identified within the boundaries of the National Park. 95 species of fish have also been identified within the Reserve and similar inventories of amphibians and reptiles are currently being compiled. Freshwater and terrestrial invertebrates have not been systematically described in either site.

Results of these preliminary inventories are of particular relevance to the proposed project. First, a number of the identified birds and mammals in both the Park and Wildlife Reserve are known to be endangered or threatened with extinction. Control of logging along streams and limitation on the cutting of food sources are the type of project activities that can minimize impacts on their local populations and should be particularly emphasized. Second, within the reserve there appears to be a marked negative correlation between the density of large mammals (e.g. Brazilian tapirs Tapirus terrestris and collared peccaries Tayassu tajacu) and the presence of logging activities. Visits to logging camps have produced clear evidence of subsistence hunting and this is undoubtedly the primary cause of this correlation (FAN and WCI, 1993). Similarly, bird species diversity in the Reserve is lowest at the only inventoried site known to have been logged within the past several years. This latter result may be largely due to logging-induced changes in forest structure, such as the increased opening of the canopy that is produced by the felling of trees and extraction of timber. The local abundances of bird species that require forest understory microhabitats may be particularly reduced by even quite selective logging (Thiollay, 1992).

Lomerio - The avifauna of Concepción have been recently and extensively surveyed by Davis (1992) and their abundance in the Lomerio project site is undoubtedly quite similar. Davis (1992) recorded 257 species, of which perhaps 70% are permanent residents, and noted that forest-dwelling species are particularly threatened by human alteration of their natural habitat, with more than half not observed in anthropogenically disturbed environments. The other fauna of the Lomerio project site has apparently not been systematically inventoried and there is no basis upon which to predict its similarity to Bajo Paragua or other inventoried sites in northeastern Bolivia. The only available data are anecdotal descriptions of local fauna gathered by the team during the brief field visit. Several local residents reported that, although Chiquitano people do hunt, there are cultural proscriptions against over-harvesting. They cite as evidence of this claim the continued presence of tapirs, peccaries, agoutis and several species of primates within the Lomerio forests. Impacts on wildlife populations of selective timber harvesting in the Lomerio communities is similarly undocumented.

The Chiquitano people are widely known for the wild honey that they collect and occasionally sell. Reportedly, they distinguish six bee species and actively protect nests and nectar-providing trees.

### 2.3.2 Fauna - Threatened, Endangered or Sensitive Species

Bajo Paragua - Several species that may occur within the Moira concession are recognized as endangered under the U.S. Endangered Species Act (CFR 50, Parts 17.11 and 17.12, dated July 15, 1991). Others are listed by the Convention on International Trade in Endangered Species (CITES) as Appendix I (threatened with extinction) or Appendix II (not currently threatened but may become so unless trade is regulated). Finally, some species not listed either by the ESA or CITES are recognized by experts in Bolivian wildlife as threatened with local extinction.

Habitat mapping will be carried out for the first time by the project. Animals that may occur within the Bajo Paragua project site are listed below:

<u>Scientific name</u>	<u>Common name</u>	<u>Status+</u>
<b>Mammals:</b>		
<u>Panthera onca</u>	Jaguar	ESA - Endangered
<u>Pteronura brasiliensis</u>	Giant river otter	ESA - Endangered
<u>Myrmecophaga tridactyla</u>	Giant anteater	CITES Appendix II
<u>Tamandua tetradactyla</u>	Collared anteater	CITES Appendix II
<u>Lutra longicaudis</u>	Long-tailed river otter	ESA - Endangered
<u>Felis concolor</u>	Puma	CITES Appendix II
<u>Felis wiedii</u>	Margay	ESA - Endangered
<u>Felis jagauroundi</u>	Jagauroundi	ESA - Endangered
<u>Allouatta seniculus</u>	Red howler monkey	CITES Appendix II
<u>Allouatta caraya</u>	Black howler monkey	CITES Appendix II
<u>Ateles paniscus</u>	Black spider monkey	CITES Appendix II
<u>Callithrix argentata</u>	Silvery marmoset	CITES Appendix I
<u>Cebus spp.</u>	Capuchin monkeys	CITES Appendix II
<u>Aotus spp.</u>	Night or owl monkeys	CITES Appendix II
<u>Saimiri sciureus</u>	Squirrel monkey	CITES Appendix II
<u>Speothus venaticus</u>	Bush dog	CITES Appendix I
<u>Chrysocyon brachyurus</u>	Maned wolf	ESA - Endangered
<u>Tayassu pecari</u>	White-lipped peccary	CITES Appendix II
<u>Tayassu tajacu</u>	Collared peccary	CITES Appendix II
<u>Tapirus terrestris</u>	Brazilian tapir	ESA - Endangered
<u>Priodontes maximus</u>	Giant armadillo	ESA - Endangered
<b>Birds:</b>		
<u>Harpia harpyia</u>	Harpy eagle	ESA - Endangered
<u>Falconidae spp.</u>	Falcons**	CITES Appendix II
<u>Accipitridae spp.</u>	Hawks, eagles**	CITES Appendix II
<u>Anodorhynchus</u>		
<u>hyacinthinus</u>	Hyacinth macaw	Locally threatened*
<u>Ara glaucogularis</u>	Blue-throated macaw	CITES Appendix I
<u>Ara macao</u>	Scarlet macaw	CITES Appendix I
<u>Psittacidae spp.</u>	Parrots, macaws**	CITES Appendix II
<b>Reptiles:</b>		
<u>Caiman latirostris</u>	Black caiman	ESA - Endangered

+ Where species are listed both by the ESA and CITES, only the ESA listing is referenced.

\* Wallace and Painter, 1992

\*\* All species in these taxa not listed in CITES Appendix I are listed in CITES Appendix II.

Lomerio - Anecdotal reports of tapirs, peccaries and several primate species within the Lomerio forests suggests that these and perhaps other threatened, endangered or sensitive species occur there as well. The current lack of faunal inventories in Lomerio precludes an accurate assessment.

## 2.4 Land Capability and Use

Land capability assessment has a long history in Bolivia, derived in large measure from the system developed by Joseph Tosi of the Tropical Science Center in Costa Rica. Capacidad de Uso Mayor de la Tierra (CUMAT) is an NGO originally created by USAID to apply the TSC methodology in Bolivia. Capability represents the optimum sustainable use of the land under given levels of technology, capitalization and accessibility. When a capability map is overlain on an actual use map, areas of potentially destructive use and under utilization are revealed. In the case of the Bajo Paragua, and specifically the Moira concession, no maps of either capability or actual use exist.

#### 2.4.1 Land Capability

Bajo Paragua - Topography ranges from flat to gently rolling. The dominant constraint affecting the use potential of the Bajo Paragua is the soil. Soil characteristics include infertility, excessive drainage, shallowness in the vicinity of granite outcrops and, paradoxically, over extensive areas soils with either a high water table and/or subject to annual flooding. In that soils of better structure and fertility exist in the Quaternary lowlands west and south of the Bajo Paragua shield area, there is little incentive to promote what would be ephemeral colonist settlement or highly capitalized crop or livestock production on these poor soils. The site is 600 kilometers from Santa Cruz de la Sierra, the nearest market and source of agricultural inputs - by dirt road. The combination of poor soils and isolation should slow the rate of colonization in this area.

This leaves forestry and ecosystem protection as the only viable uses of the area. After eliminating granitic balds, lakes, wetlands and at least two classes of grasslands one is left with forested lands which must be examined in greater detail to determine what areas can support economically viable forestry. The forest vegetation is described in more detail in the flora section above. Without more extensive field investigation it cannot be determined whether poor stocking in several areas is due to poor site conditions or to previous land use or fire history.

Lomerio - Areas of steep slopes and/or thin soils should be used for watershed protection or highly selective logging and production of non-timber forest products. More fertile soils of valley bottoms have potential for shifting agriculture or permanent agriculture with mulching. The highest potential over much of the area is forestry, agroforestry, and some controlled grazing.

#### 2.4.2 Actual Land Use

Bajo Paragua - There are two user groups within the Moira concession that are representative of the Bajo Paragua region in general. The concession employs over 500 people during the peak of dry season operations of its sawmill and veneer facility. These people are engaged in locating and cutting trees, vehicle operation, veneer/sawmill operations and various support activities. Any area containing marketable concentrations of timber is subject to logging. Logged areas and areas with timber production potential will be mapped during project implementation.

Near the mill is the village of La Florida with 35 families. Some of the men are contract employees of Moira during at least half the year while others have agricultural clearings for subsistence and some sales to the mill. A herd of some 30 cattle graze on the runway and surrounding abandoned agricultural land. In proportion to the area of the concession, agriculture occupies a minuscule part. "Log hunter" contract employees and some of the villagers engage in hunting. The areas in which they operate and the impact on the fauna have yet to be determined.

Lomerio - Current land use involving shifting agriculture on lower slopes and forestry is sustainable at the current population density. More questionable is the extensive use of fire that extend savannas of unpalatable grasses and shrubby, fire resistant trees. The savannas are extensively grazed by cattle but the stock density is exceedingly low.

### 3.0 ENVIRONMENTAL IMPACTS OF ALTERNATIVE ACTIONS

Current resource uses affecting the forest environment of eastern Bolivia include agriculture, livestock production, extraction of timber and non-timber forest products, and hunting. Within the Bajo Paragua Production Forest Reserve and specifically the Moira concession, only timber extraction and hunting are significant. This narrow range of human interventions is due to a combination of the unattractiveness of the poor Pre-Cambrian shield soils to colonists, the sparse resident population, the remoteness of the area from the settlement frontier, and firm actions by the concessionaire to remove people attempting to move in. At the second site, Lomerio, agriculture is relatively stable, hunting pressure is high and burning for pasture is a major cause of forest degradation. However, the Chiguitano community is dedicated to making sustainable forest management work.

This EA considers in detail ~~two alternatives~~; "no project" and the ~~project as designed~~. "As designed" has a very different connotation for the EA team in this project. All too often the EA team is presented with a development project designed by a team of economists, engineers, agronomists and foresters. If the EA makes a compelling case for modification, the process is at best slow, costly and often resented by donor and beneficiary alike. In the case of the Sustainable Forestry Management (BOLFOR) Project, the design and the EA were part of an interactive process. The forester, ecologists, marketing specialists, social scientist and economist interacted in the field and contributed to a design which takes into consideration mitigative measures and the research and training needed to assure that such measures are as effective as possible. Where doubt exists, ~~supplementary EAs are advocated~~. This EA serves to document the process of integrating environmental concerns in project design.

~~An alternative that warrants consideration is the use of project funds to support protection of tropical forests and wildlife. Maintenance of tropical forest cover and wildlife is a goal of the project, but one approached from a radically different direction. Protection presupposes protected status. Some 10 percent of Bolivia's national territory has park and protected area status, much of it in tropical forest. USAID, World Bank and other donors and NGOs are actively supporting Bolivia in its efforts to assure the integrity of areas now designated as parks and protected areas. This project seeks to maintain viable forest ecosystems in substantial areas of Bolivia's national territory not now in parks or ever likely to be. The mechanism is ecologically, economically and socially sustainable management of tropical forests for timber and other products. This approach is highly complementary with park protection. For example, the Moira concession abuts the Noel Kempff Mercado National Park and the Rios Blanco y Negro Wildlife~~

Reserve. ~~A managed forest will serve as a better buffer than pasture or small holder colonization.~~

The time is opportune for this project. Both Bolivia and the major international markets for tropical timber and non-timber products are in the process of being closed to all but products certified as being from sustainably managed forests. This project will encourage that process by thorough research on what constitutes sustainable management under different conditions, training in management and related fields, technical assistance and policy dialogue. The project will work in close coordination with Bolivian institutions seeking to implement the sustainable use provisions of the Pausa Ecológica, the Forest Stewardship Council, the International Tropical Timber Organization, and any other group seeking workable approaches to sustainable management of tropical forests.

Key issues to be addressed include:

- \* Impacts on forest ecosystems
- \* Impacts on plant and animal diversity
- \* Impacts on the sustainability of the forest resource

### 3.1 Impacts of the No Project Alternative

The "no project" scenario assumes that USAID does not fund a project dedicated to sustainable management of tropical forests. The scenario also assumes that neither the government of Bolivia nor another donor launches a similar project in the foreseeable future.

~~National-scale impacts --~~ The project has a strong orientation toward building the capacity of public and private institutions to sustainably manage Bolivia's tropical forests. Without the research, training and demonstration envisioned in the project, ~~Bolivia will find it more difficult to meet the 1995 Pausa Ecológica goal of having all lumber exported be from forests certified as being managed sustainably.~~ The project includes certification of finished wood products and non-timber products as well. ~~Without the strong production and conservation complementarity that assures sustainability while increasing the value of the forest through broadened markets, pressures to convert the forest to other uses will increase.~~

~~Site-specific impacts --~~ Specific impacts of the no project alternative are discussed for the Moira concession in the Bajo Paragua and the Lomerio area southeast of Concepción, both in Northeast Santa Cruz. The focus is primarily on the impacts of

uncontrolled logging, burning and hunting on forests, biodiversity and sustainability of resource use.

### 3.1.1 Impacts of Current Logging Practices on The Forest Ecosystem

~~Bajo Paragua - There are apparently no data from Bajo Paragua Forest Reserve on the effects of logging on forest structure, composition, ecosystem function, or the sustainability of resource use. On the basis of the EA team's visit to the Moira Concession in Bajo Paragua, however, some of the effects of logging can be described. Furthermore, to the extent that the conditions in Baja Paragua resemble those in Chimanes Forest Reserve, effects of current logging practices in the former can be assumed from studies conducted in the latter by R.E. Gullison et al. Determining the nature and extent of logging effects in Bajo Paragua is one of the goals of the BOLFOR project.~~

Current harvesting practices in Bajo Paragua are obviously not sustainable from a wood production point of view. The disregard for future productivity is nearly complete. The claim by the Moira Concession staff that seed trees are retained is only true insofar as hollow or otherwise non-commercial trees are not extracted. No silvicultural treatments are currently in use that would increase stocking of commercially valuable trees or increase the growth rates of the smaller trees that survive logging.

Most Bolivian lowland forests have apparently already been logged at least once. In the Moira Concession, the last round of logging occurred about 10 years ago; now they are extracting trees that were missed, others that have grown to harvestable size, and species that have increased in commercial value during the intervening years (e.g., Amburana). The next round of logging will probably target more species, poorer quality logs, and smaller trees. From either a commercial or an ecological sustainability perspective, none of these anticipated changes are positive.

Forest management is currently not practiced in the Bajo Paragua (nor elsewhere in Bolivia to the best of our knowledge); the forest is simply "high-graded" or "creamed" for high value logs. In the Moira Concession, 8-10 teams of about 10 contracted tree-finders each search the forest for trees more than 60-70 cm in diameter at breast height (1.4 m; DBH) of Swietenia ("mahogany" or "mara"), Cedrela ("tropical cedar" or "cedro") and Amburana ("tropical oak" or "roble"). They inscribe their initials on the trees to be cut and are paid by the number of trees they find. Relocating the trees is facilitated in some areas by a 200 x 200 m grid of cleared lines through the understory. During the dry season the same teams fell the selected trees and direct the skidder drivers to their locations.

The felling, timber extraction, and timber hauling practices in the Moira Concession cause more damage than is either necessary or cost effective. This statement could be applied anywhere in the Bolivian Oriente where logging is taking place. Commercial trees are felled without regard to the location of skid trails or the distribution of advanced regeneration (seedlings, poles, or small trees) of commercial species. Unfortunately, because directional felling is not practiced, before many of the logs can be skidded to log landings they must be rotated using the blade of the skidder. Because vines connecting the tree to be felled with neighboring trees are not cut prior to logging, trees not directly hit by the felled tree often suffer mechanical damage. Given the concessionaire's estimation of the proportion of hollow trees of commercial species (more than 50%), mechanical damage and subsequent attack by fungi, termites, and other wood-eating organisms represent a serious threat to long-term economic viability of timber harvesting. It should be pointed out, however, that the major factor contributing to this high proportion of hollow trees is probably fire.

Unnecessary damage to the forest and inefficient utilization of the trees felled is also due indirectly to the policy of assessing taxes. The current policy makes it to the logger's distinct financial advantage to extract from the forest only the choicest logs. Substantial quantities of valuable timber are left to rot on the forest floor or at log landings. The policy component of the project will promote alternative revenue collecting alternatives and incentives such as technologies for adding value to wood not suitable for sale as sawn timber.

Forest damaged by logging in this manner are prone to fire and weed infestation. Logging slash on the forest floor constitutes fuel for the fires that apparently occur quite frequently in the Bajo Paragua area. The presence of numerous careless cigarette smokers and camp fires in the area increase the likelihood of ignition; the added fine fuels (logging slash) increase fire intensity. Canopy opening also promotes the proliferation of the already abundant vines. Once vines have come to dominate an area, tree regeneration may be postponed for decades. On the other hand, it should be pointed out that large canopy openings are apparently required for the successful regeneration of Swietenia.

One mitigating factor for logging in Bajo Paragua is the low stocking of currently marketable timber species. Although reliable data on stocking in the area are not available, it appears that on average, not more than one tree is extracted per hectare. On the basis of the logging damage model for Chimanes Forest Reserve, felling and extraction of 1 tree per hectare will result in about 20% of the forest being damaged. This estimate includes neither the potential effects of fire nor the subsequent proliferation of vines and other weeds that with time spread outward from areas

directly effected during logging.

~~We anticipate that the intensity of logging in Bolivia will increase in the near future.~~ Many tree species that are harvested in Brazil are currently not harvested in Bolivia, apparently due to higher transport costs. As markets expand and stocks of well-known and high-valued species are depleted, these other species will likely be harvested in Bolivia. Increased harvesting intensity will greatly increase logging damage, especially if current uncontrolled practices continue.

### 3.1.2 Impacts of Current Logging Practices on Plant and Animal Diversity

**Bajo Paragua** - Although data are not available on the effects of logging on plant and animal diversity in Bajo Paragua, studies conducted elsewhere in the tropics allow estimation of the likely consequences. The major problem with using data from forests in other countries is that logging intensities in Bajo Paragua are much lower than the norm.

Although the proportional representation of species may change dramatically, logging rarely results in the extinction or even local extirpation of plant species. In Bajo Paragua, because average logging intensities are very low and only large trees of primarily three species are extracted, the effects on plant species diversity are also probably correspondingly low. In contrast, logging undoubtedly has a substantial effect on population structures of both commercially valuable and light-demanding weedy species. Weeds are particularly abundant along skid trails and extraction roads in Bajo Paragua. Also, removal of most of the seed-producing trees of the commercially valuable species undoubtedly influences the viability of their populations but research is needed to determine the extent of these effects.

The effects of selective logging on animals depends on the species concerned and whether or not hunting is practiced. The characteristics of the tree species extracted is also likely to be an important determinant of the impacts of logging on animal populations, but this has been little studied. In Bajo Paragua, however, three of the most valuable tree species (Swietenia, Cedrela and Amburana) are apparently not widely used by wildlife for food; the extraction of other species considered for marketing (e.g., Ficus sp. "bibosi") may very well have a much greater effect. Bibosi and other candidate tree species will be subjected to an assessment of the potential impact of their removal on ecosystem processes and particularly on fauna. Furthermore, tree species felled as part of the logging operation (e.g., in the process of road construction) can be important to wildlife as food resources.

The impacts on fauna of unaltered practices by the Moira concessionaire are difficult to gauge in the absence of clear documentation, but they are likely to be severe for some and perhaps many species. These impacts may take several forms:

\* First, the concessionaire employs seasonal laborers ("tree-finders" or "contratistas") to search for commercial tree species throughout large areas of the concession. Tree-finders later return to cut the trees they located. Eight to ten teams of 8-10 men plus women and children each year spend several months at a time in the forest. Although wildlife hunting is illegal, they are not provided with alternative sources of animal protein, carry guns, and likely engage in subsistence hunting at a level that may have a substantial negative impact on wildlife populations (Taber, pers. comm.; Taber and Rumiz, 1993).

\* Second, the current practices of commercial logging fail to incorporate harvesting techniques that would help minimize impacts on wildlife (e.g., the protection of streamside vegetation and trees that produce fleshy fruits during seasons of low fruit production in the forest).

\* Finally, current logging practices appear to be decreasing the population of commercial timber species of harvestable size such that over time there may be an increased incentive to convert forest to other land uses (representatives of the Moira concession spoke of plans for citrus production and cattle ranching), to illegally cut timber outside the concession within the boundaries of the adjacent national park, to increase the number of tree species harvested within the concession and to cut trees below the minimum cutting limit. Such changes in forest use which may reasonably be expected to arise from the concessionaire's currently unsustainable harvesting practices would have serious repercussions for wildlife.

Animal species not actively sought by hunters may also be affected by selective logging in Bajo Paragua. Logging of 3 trees/ha in French Guiana, for example, resulted in the loss or sharp decrease in populations of 42% of bird species; even 10 years after logging the bird populations had not recovered (Thiollay 1992). Cox and Taber (unpublished) report that in the Rio's Blanco y Negro Wildlife Reserve in Bajo Paragua Forest Reserve (west of the Moira Concession), logged forests have 30% fewer bird species than nearby unlogged forest. Determining the effects of current logging and hunting practices on animal populations and the extent to which that these effects can be reduced is one of the goals of the BOLFOR project.

This ~~reduction of forest wildlife populations~~, whether through hunting, timber harvesting, or forest fragmentation can have also severe and largely unrecognized effects on the forest ecosystem. Invertebrate and vertebrate fauna play direct and essential roles in the structuring and regeneration of tropical forest vegetation through ~~herbivory, pollination, seed predation, seed dispersal and nutrient decomposition and cycling~~. Often these roles are highly species-specific, as when a forest tree is pollinated by only one or a few species of insects, birds, or bats. Some authors have also suggested that large mammalian predators such as jaguars and pumas may have a substantial indirect effects on the structure of forest vegetation by decreasing the populations of seed and seedling consuming rodents and other small mammalian herbivores (Terborgh, 1992; Taber & Rumiz, 1993). Such effects will need to be better understood for ecologically sustainable forest management practices to be devised.

Lomerio - It is difficult to judge the impact on fauna of current forest management practices by members of the Lomerio communities. Community members claim to engage in sustainable levels of subsistence hunting, but this has not been systematically evaluated. Similarly, the impacts on fauna of current timber harvesting practices is undocumented.

### 3.2 Consequences of the Project as Designed

The project supports sustainable logging and extraction of non-timber forest products with full knowledge that any intervention will result in some disruption of ecosystem functions and loss of biological diversity. However, when compared with the "no project" alternative the project is designed to have a markedly lower impact on natural system values in two distinct ways.

\* First, significantly increasing the economic value of the forest (and public awareness thereof) will result in:

(a) those who control public or private forested land not in production reserves making the decision to manage the forest rather than convert it to other uses, and

(b) those who have concessions or use rights to production forests vigorously defending that economic resource against illegal intrusions.

\* Second, through research, training, demonstrations, and information dissemination the project will assist public sector institutions and forest based industries in defining and implementing forest management plans that

meet the letter and spirit of national and international certification requirements.

In contrast, the no project alternative would leave the Bolivian public and private sector at odds over how to technically carry out sustainable forest management under the economic threat of mounting international pressure. Continuation of uncontrolled forest exploitation in narrowing world market will increase the probability that forest lands will be converted to other uses.

An important element of the project is its high profile. Other countries, donor agencies, the scientific community, and NGOs are watching for results. The opportunity exists under the unique conditions prevailing in Bolivia to demonstrate sustainable management approaches for timber and non-timber forest products. The project will participate in several research and information exchange networks, publish results in the international literature, and create an integrated series of video-based training modules on forest management and related topics for pantropic distribution.

### 3.2.1 Impacts of Project Activities on the Forest Ecosystem

**Bajo Paragua** - The Bajo Paragua Forest Reserve is a complex of moderately dense forest, cerrado (scrub forest) and savanna on thin soils, swamps, and marshes, and rock outcrops (inselbergs). Although project activities will focus on the forests, the distribution of vegetation and soil types needs to be ascertained. Furthermore, among the forested areas are sites that have been logged once or several times, burned areas, stands well stocked with plant species important to wildlife, buffer strips along water courses and lakes, and etc. Other forest reserves in Bolivia are equally complex but expertise in mapping and forest inventory is not yet well developed. The forest manager in the Moira Concession, for example, has a satellite image that has been neither interpreted nor ground-truthed; he seems to rely on the memory of his field crews to decide which areas to target for logging.

The BOLFOR project will support the development and implementation of a remote-sensing forest classification system. Vegetation maps based on infra-red airphoto or video interpretation with substantial ground-truthing will be developed for Bosque Chimanes and then implemented in Bajo Paragua Forest Reserve. The advantage of the Bosque Chimanes site is that 14 all-species 1-ha plots have already been set up by R.E. Gullison and associates. *mapping* Vegetation mapping activities are not anticipated to have any deleterious environmental impacts but will provide a firm basis for efficient, and ecologically-sound forest management planning.

*inventory* Using the vegetation map of the Moira Concession, inventory methods

~~will be developed and implemented.~~ Along with collecting data on timber stand volumes, population structure, and tree species composition, teams of researchers using the same inventory grid will collect basic data on fire and wind-storm history, indications of previous human activities, soil, and wildlife populations. With these extensive data in hand, sites can be more rationally selected for more intensive study.

*research*  
The project focus is on sustainable forest management and consequently much of the ~~research will revolve around management techniques.~~ The silvicultural studies outlined below will be complimented by studies on plant and animal diversity (described in Section 3.2.2) and on the sustainability of resource use (Section 3.2.3). The silvicultural research proposed is divided into three interrelated components: felling, extraction, and stand improvement treatments.

#### 3.2.1.1 Studies on felling damage

When a tree falls (or is felled) in the forest it invariably and unavoidably damages its neighbors. Studies in other parts of the tropics indicate that felling damage can be substantially reduced by cutting woody vines on the tree to be felled prior to logging and by directing its fall so as to reduce damage to potential crop trees and to facilitate extraction (i.e., to avoid having to rotate the log prior to skidding).

*\**  
~~Research in the Moira Concession on the effects of pre-felling vine cutting on the number of neighboring trees damaged will be carried out on single trees as well as in replicated 5-10 ha plots in which a variety of silvicultural treatments will be imposed. Vines more than 2 cm dbh growing in the crowns of the trees to be felled will be cut at least 6 months prior to logging to ensure that they break easily. Labor costs and potential silvicultural benefits (i.e., ancillary damage) will be assessed. Because most uncut vines are expected to survive falling, resprout, and proliferate in logging gaps, the replicated permanent 5-10 ha plots (reduced impact vs. conventionally logged) will allow determination of the effects of pre-felling vine cutting on post-felling vine density. The effects of this treatment on the animal community will also be assessed.~~

*\**  
The hypothesis that directional felling results in reduced damage to potential crop trees will also be tested. Again labor costs will be recorded and a cost-benefit analysis conducted. Studies on directional felling in Suriname, Costa Rica, and Malaysia have indicated reduced logging costs from directional felling because skidding time is substantially less when logs do not have to first be re-positioned. Whether this is the case in Bolivia remains to be seen; the necessary studies will be carried out in 5-10 ha plots paired on the basis of number merchantable trees and logged either with or without directional felling. Training of sawyers in

directional felling techniques will be provided by the project.

### 3.2.1.2 Log Extraction Methods

Efficient ~~skid trail layouts and the use of cable winches~~ have been shown to result in reduced logging damage. In Bosque Chimanes, for example, Gullison and Hardner (in press) found that the total area of forest damaged in skid trails could be reduced by 25% had their locations been more efficiently determined. In other parts of the tropics and presumably with higher logging intensities in Bolivia, even more substantial damage reductions are possible with well designed skid-trails. ~~If instead of driving all the way to the log skidder operators used their cable winches for the last 25-30 m,~~ forest damage could also be reduced.

Members of the BOLFOR forestry research team will conduct studies on current log extraction methods and on the reduced impact logging methods described above. This research will be carried out in the replicated ~~5-10 ha plots used for studies of felling damage~~. Once again damage as well as costs will be monitored.

### 3.2.1.3 Effects of Silvicultural (i.e., Stand Improvement) Treatments

Although controlled felling and timber extraction are major components of most ecologically-sensitive forest management strategies, a multitude of additional silvicultural treatments can subsequently be prescribed. Because the regeneration requirements of the tree species for which the forest is to be managed are for the most part unknown, it seems advisable to begin with stand improvement treatments that do not greatly effect stand structure. One such treatment called "liberation thinning" has been extensively used in Southeast Asia, and tested in several forests in Latin America, as well as in one area in Santa Cruz Province (Lomerio). This technique basically consists of removing trees overtopping potential crop trees by felling, girdling, or treatment with arboricide. No trees are killed unless they are directly competing with the selected potential crop trees. Girdling (= ring-barking) is carried out with an axe; girdled trees fall apart piecemeal over a 1-2 year period and hence do little damage when they finally topple over. ~~This technique is presently being used in the Lomerio forest management project but has not yet been thoroughly tested for its silvicultural benefits, labor costs, or effects on other forest organisms.~~

The light-demanding trees species generally require more severe silvicultural treatments than liberation thinning. Felling of an average merchantable size canopy tree, for example, opens a 110-200 m<sup>2</sup> canopy gap and favor the advanced regeneration of moderately shade tolerant species. If the forest is managed for more light-demanding species, larger openings will need to be opened.

Regeneration clearings can be in narrow strips or in small patches. In either case the costs are higher than in liberation thinning (unless smaller trees of a variety of species are marketable) and the hazard of weed proliferation is greater. When basic ecological data on trees in Bajo Paragua are available, the project will conduct experiments with different "monocyclic" silvicultural systems.\*

### 3.2.2 Impacts of Project Activities on Plant and Animal Diversity

Bajo Paragua - The BOLFOR project proposes to engage in several activities that may affect wildlife within the Moira concession. First, several natural forest management research plots of ca. 0.5 ha to a maximum of 10 ha each will be established to examine the effects of silvicultural treatment on the growth and regeneration of commercial tree species. Silvicultural treatments will include measures to minimize collateral damage to unharvested trees (e.g. the cutting of vines that connect trees to be harvested with other trees and directional felling) and measures to enhance the regeneration of trees of commercial species (e.g. the removal of trees of non-commercial species near immature mahogany trees in order to reduce competition for light and nutrients). Second, vegetation maps of the Moira concession will be developed in order to determine where forest suitable for timber production is located. Third, methods to reduce the risk of fires in the concession will be assessed and recommended to the concessionaire. These may include research on fire origins, development of training modules in fire prevention and control, and establishing a trained concession fire brigade.

The forestry activities carried out on the small research plots will have negligible effects on wildlife. If, however, these practices are adopted by the concessionaire (as might be reasonably expected if they enhance the rate of timber production per unit area), then their potential impacts should be evaluated on a larger scale. While vine-cutting and directional felling are likely to have quite benign effects on fauna relative to current practices, liberation thinning may have a substantial negative impact if it is adopted more widely within this concession. A negative impact may arise if non-commercial trees provide important food resources or nesting habitat for forest-dwelling fauna, or if their removal more generally alters the forest habitat (Thiollay, 1992; Crome, 1992). The key issue is the scale and intensity at which liberation thinning takes place, with the extent of impact positively correlated with the number of trees removed per hectare and the number of hectares of contiguous forest in which trees are removed. The effects are difficult to gauge, but should be carefully assessed during a supplementary EA before project activities directly or indirectly encourage liberation thinning by the concessionaire.

Vegetation mapping will allow the project to identify areas of commercially productive forest and to make recommendations to the concessionaire about where to concentrate tree-finding and logging efforts. Since subsistence hunting by tree-finders/loggers is likely the primary cause of wildlife loss in Bajo Paragua forests, vegetation mapping might have a ~~positive impact on wildlife~~ populations if its results lead the concessionaire to hire fewer tree-finders to spend less time in a more circumscribed area of the forest. The control of anthropogenic fire within the concession may also have positive benefits for wildlife.

Finally, several activities that may be undertaken by the BOLFOR project have the potential to enhance wildlife conservation within this logging concession and in other managed forests in Bolivia (Taber and Rumiz, 1993). These include:

- the collection of baseline data on wildlife abundance and diversity within the concession.

- the assessment of wildlife use by subsistence hunters within the concession to evaluate (1) the impact of hunting on prey species populations and (2) the effectiveness of different strategies to reduce hunting to ecologically sustainable levels.

- the identification of "keystone" species (e.g. Ficus spp.) and habitats (e.g. streamside corridors) for wildlife within the concession and the incorporation of their protection into recommended forest management plans.

- the monitoring of the impacts of different timber harvesting regimes (e.g. liberation thinning on pre-felling vine cutting) on wildlife populations.

Such research and monitoring will be essential if the project is to determine the conditions under which tropical timber can be extracted in an ecologically sustainable manner.

Lomerio - The BOLFOR project currently plans to provide the Lomerio communities with technical assistance on fire prevention harvesting methods and research techniques. These activities are likely to have benign or positive impacts on wildlife populations. The project may wish to further assist these communities to minimizing the impacts of their current selective timber harvesting activities on fauna by providing them with additional training, for example, in the identification and protection of keystone species and habitats.

### 3.2.3 Impacts of Project Activities on Sustainability of Forest Resource Use

Project activities will have impacts on forest resource use, both direct and indirect. ~~Obvious causes of impacts will be forest management plans promoted by the project and certified under yet-to-be defined mechanisms. How to minimize the impact of logging, extraction of non-timber forest products, and related activities such as hunting are the focus of most of the project design and this EA.~~ Indirect impacts are discussed in the Section 3.2.4.

One major goal of the BOLFOR project is to help develop sustainable forest management practices. Current practices are clearly not sustainable in terms of timber yield from harvested species; ecological sustainability is likewise unlikely. Research sponsored by the project will provide the ecological information necessary to design sound approaches to forest management, will develop appropriate silvicultural methods, and will test these methods on both experimental (e.g., 5-10 ha plot) and commercial scales (e.g., 1,000-10,000 ha). Timber yield will be monitored as will the effects of harvesting methods and stand improvement treatments on both plant and animal communities, and ecosystem properties.

If the effects on a tree population of a harvesting regime and associated silvicultural treatment are ~~sustainable~~, this is equivalent to saying that population size does not tend to decrease over time. To make such a claim data are needed on reproductive output, seed predation, germination, establishment, growth, and survival. There are a number of accepted short-cuts but collecting the requisite data is nevertheless a major undertaking involving a number of interrelated studies that will be conducted over the life of the BOLFOR project. Population studies ~~will be conducted on currently marketable timber species, timber tree species with potential, and non-timber product producing species (e.g., palms harvested for their edible terminal bud).~~ The types of studies needed to assess population sustainability of a management program are outlined below.

Alternative species studies - The ecology of dozens of potentially valuable species in Bolivia have received little attention from researchers and the silvicultural treatments that favor their regeneration and growth are apparently not known. In other words, if these species are to be managed in a sustainable fashion, studies will have to start more-or-less from scratch. The goals of these studies will be to document the effects of current harvesting practices on populations of these species, and to understand enough of their ecology to design sustainable management plans. Rather than fund researchers solely from abroad to undertake these studies, the BOLFOR project envisions having experts working closely with Bolivian students working on their senior theses, Bolivian post-graduate students, and employees of the research branch of the Cámara Nacional Forestal and other organizations.. The project will provide financial and logistic support but, more importantly, it will provide scientific guidance and training.

One major problem with which the project will necessarily have to deal is that tree species differ in their ecological requirements; the appropriate silvicultural techniques likewise varies among species. Some species are light-demanding and require large canopy openings for successful regeneration (e.g., Swietenia). Other species suffer from excess heat or light in large canopy gaps, especially if the gaps are opened suddenly. The conditions that favor light-demanding trees of commercial species unfortunately also favor light-demanding vines and other weeds.

EA If regeneration of the commercially important or potentially important tree species depends on fairly radical stand manipulations, the project will have to address the deleterious effects on shade-loving animals and plants. Where the balance will be found between fostering regeneration of commercially valuable species and keeping environmental effects to a minimum remains to be seen. It should be kept in mind, however, that stand dominance by tree species adapted to major disturbances suggests that disturbance, natural or anthropogenic, has played an important role in stand development.

Ecosystem scale studies - The major component of a population stability analysis is population structure (i.e., size-class frequency distribution) and the growth rates and survivorship probability of trees in each size class. These data emerge from permanent plots subjected to different silvicultural treatments and then monitored over a period of years. Studies on spatial distribution in relation to light levels, or topographic position, along with physiological studies on light, nutrient, and moisture relations serve as strong complements to the longer-term plot based studies. Using data on population structure and the probability that individuals survive and make the transition from one size class to another allows calculation of population stability. Calculation of population stability under different management regimes (either imposed or mathematically simulated) are made using matrix algebra (population projection and sensitivity analyses). Determination of the appropriate silvicultural management technique for 10-12 tree species and possibly 5 as many of non-timber product producing species will be among the challenges awaiting researchers.

The only way to address these very fundamental issues is by developing an understanding of the forests that currently are being degraded or destroyed. The BOLFOR project does not pretend to already have this understanding but intends to foster its development through sponsoring the requisite training and research.

In addition to helping to develop forest management practices that result in sustained yield of timber, the BOLFOR project will address broader issues of sustainability (e.g., maintenance of species diversity, water quality, wildlife populations, and

biogeochemical processes). The priorities for research, however, are not yet clear. For example, soil compaction and stream sedimentation are major problems in many logging areas but do not seem to be particularly acute in Bajo Paragua. The probable role of fire in the area and the effects of logging and silvicultural treatment on fire frequency and intensity, in contrast, are very real concerns that will be addressed once some baseline data are available.

#### **3.2.4 Indirect Impacts of Value-Added and Marketing Activities on Sustainability of Forest Resource Use**

The sustainability of the value-added/marketing component is dependent on success in achieving sustainability in forest management. Current practices will lead to the elimination of mahogany as a significant export commodity in Bolivia before the BOLFOR project begins to have an impact on forest management. Other timber and non-timber products could follow in the wake of mahogany for the reasons stated in the caveat on the need for constraints on cutting (Section 1.3).

Value-added and marketing activities will impact the forest resource as a whole through increased demand, either overall or for selected species. Value-added through processing into finished or semi-finished products may increase efficiency of forest product use. For example, mahogany stumps can be processed into high value burl veneer, short pieces of wood can be carved into chair legs, raw boards converted into precisely finished furniture components, and Babassu nuts converted into oil, activated charcoal and cattle feed. The danger is success. Unless management plans, legal constraints and education are in place, success in adding value to a specific product can result in unsustainable pressure on that resource, wildlife or the ecosystem itself.

Broadening the range of species used has an obvious appeal as the mainstay of the timber industry, mahogany, disappears. More species from a given site offers the opportunity to reduce overall system impacts by concentrating logging activity in smaller areas for the same overall value of products removed. This potentially increases profitability, reduces road construction and in some cases may result in increased regeneration of such species as mahogany. Again, the danger is success in the absence of constraints. Broadening of species base of the forest products industry will occur with or without the project. After carefully assessing the sustainability of the harvest of each candidate species and assessing the system level impacts, the BOLFOR project would explore how species can be utilized in the context of a site-specific sustainable forest management plan. Forest management plans will first be developed in the Moira concession and the Lomerio community forest following research on impacts and

sustainability.

One approach to adding value which will not be advocated is the use of species or whole arrays of species for high volume/low value purposes such as biomass fuel, paper pulp, chipboard or plywood core material.

#### 4.0 Mitigative Measures

The following mitigative measures will enable USAID/Bolivia and the BOLFOR Project participants to offset, minimize, or avoid any possible adverse environmental effects and to ensure that project activities are carried out in an environmentally sound manner. The measures presented are primarily directed to ensure that forestry and associated project activities are carried out in a manner that, in accord with Section 533(c)(3) of the 1991 Foreign Operations Appropriations Act, maintain the forest's ecological functions and minimize impacts to biological diversity. Note that many of these mitigative measures are based upon the current plans of the BOLFOR project design team and are fully consistent with the project's goals and objectives. While the measures discussed in this section reference the Moira concession, they are widely applicable to other sites in the humid tropical forests of Bolivia.

#### Mitigative Measures for Currently Specified Project Activities:

*Not accepted*

1. Prior to the establishment of the BOLFOR Project research plots on the Moira concession, a binding agreement should be reached between the Project, the concessionaire and appropriate public and private authorities (e.g. the Centro de Desarrollo Forestal) that (a) the research plots will be under the full control of the Project during the life of the project, and (b) the BOLFOR silvicultural research practices will not be adopted by the concessionaire until project research determines the conditions under which the ecological sustainability of these practices can be assured. This research should include, but not be limited to, an assessment of the (a) the abundance and distribution of commercial trees of intermediate size classes that would be freed from competition, (b) the abundance and distribution of wildlife populations that might be affected by this practice, (c) the identification of keystone species (e.g. non-commercial trees providing important fruit crops during periods of seasonally low fruit abundance) or habitats (e.g. streamside corridors) that should be fully protected, and (d) studies of the effects of liberation thinning and other forestry practices on biological diversity.

2. The BOLFOR project should investigate the role of natural and anthropogenic fire in the Lomerio and Bajo Paragua forests, and, as appropriate, institute fire control programs at both sites.

3. Project activities at Lomerio should support the training of community members in sustainable forest and wildlife management.

4. The BOLFOR project should support research into the subsistence use of wildlife in the Moira concession and Lomerio community to

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impossible  
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assess (1) the impact of hunting on prey species populations and (2) the effectiveness of different strategies to reduce hunting to ecologically sustainable levels.

5. BOLFOR project activities involving work with local communities (both at Lomerio and with the seasonal laborers employed by the Moira concession) should make particular efforts to ensure that research is conducted and technical assistance provided in a manner most appropriate for local social conditions. BOLFOR technical staff directly involved with this aspect of the project should therefore receive training in appropriate methods of community participation, particularly Participatory Rural Appraisal.

6. Surface surveys of archeological artifacts, and information on culturally important sites (e.g., sacred lakes, hills, etc.) are required in any areas where the Project may be involved in construction or other activities disturbing existing habitats.

7. Monitoring and evaluation of the ecological impacts of project forest management activities should be carried out in the manner specified in section 5.0.

8. Amendments to this environmental assessment should be carried out in the manner specified in section 6.0.

## 5.0 Guidelines for Monitoring and Evaluation

1. Monitoring and evaluation of the ecological impacts of forest management practices is a central component of the BOLFOR project and should be carried out on an ongoing basis and the results continuously integrated into the rolling project design. For example, monitoring the impacts of selective logging on biodiversity will require (1) baseline information on the patterns of wildlife distribution, abundance and diversity with the project sites, (2) the establishment of several replicate plots receiving different types or intensities of logging and silvicultural treatment (including a set of no logging control plots), (3) the mapping of appropriate vegetation parameters before and after logging and silvicultural treatment, and (4) the use of various (and well-established) techniques to monitor mammals, birds, forest phenology and terrestrial invertebrates in each replicate plot (e.g. Taber and Rumiz, 1993) and "downstream" effects on freshwater invertebrates where appropriate. The study of freshwater invertebrates is particularly useful as well for measuring the impacts of timber harvesting on water quality. One critical factor influencing the evaluation of these impacts is the size of the replicate plots. The planned ca 0.5 ha plots at the Moira concession, for example, are far too small to meaningfully assess the impacts of timber harvesting on most vertebrates. This should be addressed either by substantially increasing the size of research plots on the Moira concession (i.e. to ca 50-100 ha) or by conducting these studies at Bosque Chimanes as proposed by Gullison (1993) where plots of appropriate size have already been established. Gullison's (1993) proposal to develop a standardized and efficient method for monitoring biodiversity by assessing how the accuracy of a given monitoring method varies with sampling intensity may have important implications for, for example, minimizing the cost of eco-certification and should be incorporated into the project research.

Before the BOLFOR Project can establish a well-designed monitoring system to determine impacts of Project activities, studies similar to those being carried out in the Rios Blanco y Negro Wildlife Reserve will be necessary to determine the baseline conditions of biological and non-biological ecosystem components that could be affected directly by Project activities and indirectly by changes in forest management practices suggested by the Project. To rationally plan forest management programs, it is necessary to map the forest types and the distribution of commercially important species in the concession area, and in any other areas where the Project may work. Initial inventories should concentrate on forest communities containing mahogany (mara, *Swietenia macrophylla*), as Project research and demonstration activities will concentrate in these areas. The forestry and environmental/biological data are

complementary, and both are necessary for successful implementation of the Project.

It will be the responsibility of the USAID/Bolivia Project Officer for the BOLFOP Project to conduct periodic monitoring to ensure compliance with the mitigative measures. The Project Officer should work in association with the BOLFOP Project Manager to establish a time schedule for completing each of the mitigative measures and to require the Project Manager to document their implementation on a semi-annual basis. Semi-annual documentation of this environmental monitoring should be made available to the USAID/Bolivia Environmental Officer, and other interested parties who submit formal requests for the information.

LAC/DRIE  
Annex to EA

## 6.0 Guidelines for Amendments to this Environmental Assessment

Areas of concern in ~~supplementary site specific~~ EAs are related primarily to forest management plans for commercial scale extraction of forest products:

- \* Non-timber forest product extraction
- \* Forest management and silvicultural demonstrations
- \* Site-specific commercial forest management assistance

These EAs should serve a dual function; first, they will satisfy the letter and spirit of Section 533 requirements, and second, the EAs will serve as the basis for meeting national and international sustainable management certification requirements.

## 6.1 Key Issues to be Addressed

1. Future environmental assessments (technically, amendments to this environmental assessment) should be conducted for any planned project activities that are not explicitly addressed in this EA and that may have significant environmental impacts. This should include, but not be limited to, assessments of the environmental impacts of:

- Project activities that directly or indirectly promote the forestry activities described in Section 3.0 in sites other than the Moira concession or Lomerio community forests or involving silvicultural practices not described in this environmental assessment.
- Project activities that directly or indirectly promote the use of additional timber or non-timber forest products (NTFP's) in the Moira concession, Lomerio community forests or other selected sites. Excluded from these EA's should be applied research conducted to determine ecologically sustainable levels of product harvesting.
- Project activities that directly or indirectly promote ecotourism.

## 6.2 Recommendations for Supplemental EAs and Environmental Reviews

First phase activities, baseline data gathering, non-site-specific training, and preliminary research (small research plots) will contribute to the development of forest management plans. This project will assist timber concession holders (initially Moira and

Lomerio) and other forest users to develop management plans. However, prior to implementation of the site specific management plan, an EA or Environmental Review (ER) must be conducted. In binding agreements with concessionaires and other forest users, it shall be stipulated that an EA or ER must be conducted on a forest management plan (see below) prior to implementation and the findings of the EA or ER, including mitigation measures, shall be incorporated into the management plan. The sequence and process of future EAs and ERs is envisioned as follows:

**6.2.1 Initial EA and Guidelines**

The initial forest management plan EA (probably for the Moira concession) will be the most labor-intensive. Concurrently with this EA will be developed a set of harvest/environmental Guidelines drawing upon data and experience from the small research plot activities. These Guidelines will provide the basis for the elaboration of future management plans. The initial EA and Guidelines will be conducted by the Contractor who form a competent interdisciplinary team drawing upon the Contractor team, Bolivian professionals and outside experts. The findings, conclusions and recommendations of this collaborative effort must be agreed upon by all team members and be approved by the MEO and LAC/DR/E. Potential sources of outside expertise include LAC/DR/E, the R&D Bureau, BSP, the Mission Environmental Officer, the Regional Environmental Advisor for South America, consulting firms and PVOs. Priority should be given to working with experts who can also assess whether project forest management practices will meet ecocertification standards for the international marketing of forest products.

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**6.2.2 Content and Focus of EAs, ERs and Guidelines**

EAs, ERs and Guidelines will address the overall process of forest management including mitigation of impacts on biodiversity and ecosystem processes. Specifically addressed will be the utilization of new species, cumulative impacts of extracting new species, impacts of the construction of temporary and permanent roads and impacts of ecotourism. Guidelines, EAs, and ERs must incorporate the requirements and issues in 22 CFR 216 and Section 533 of the Foreign Assistance Act, as amended. Guidelines should also ensure that forest product harvesting will not be addressed on a piecemeal basis, but that cumulative impacts will be evaluated and the activity considered in an ecosystem context. Guidelines should provide for monitoring and evaluation mechanisms as developed from the small research plot component of BOLFOR.

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will not  
inc.  
ecotourism

**6.2.3 ERs for Subsequent Forest Management Plans**

The approved guidelines will be used to develop subsequent forest

management plans. ERs will be required for these plans and will be much less labor-intensive, probably requiring only a discussion of compliance with approved guidelines and applicability of the already existing EA to this specific site. Where approved guidelines and an applicable EA already exist, ERs and guidelines will be drafted by the Project Ecologist. Oversight and approval of the draft will be provided by the MEO, who must approve the ER. When using LAC/DR/E approved guidelines and ER to develop a management plan, the test to determine compliance lies with the USAID/Bolivia MEO.

Management  
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ERs  
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approved  
by  
MEO

#### 6.2.4 Triggering of Follow-On EAs, ERs and Guidelines

If the MEO determines that an earlier set of guidelines and/or an EA/ER are not applicable to a new site, a new product/species is involved, or that the cumulative impact of harvesting forest products at the site will be significant, the MEO may require a more extensive evaluation of impacts in a separate EA with accompanying guidelines. Additional EAs/ERs and guidelines will generally require a team of one to three individuals with Bolivian participation. The Project Ecologist will normally participate in this process. The level of effort involved will be determined by the MEO and the resulting documents will be approved by the MEO and LAC/DR/E.

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EAs  
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LAC/DR/E  
approval

#### 6.3 Assessments on Non-Timber Forest Products

Future environmental assessments that focus on non-timber forest products should follow a common set of general criteria for evaluating whether project activities will have a negative environmental impact. A central objective of the BOLFOR Project is to identify and promote the marketing and sustainable harvesting of NTFP's. The overarching conservation purpose of this objective is to increase the perceived value of standing forest in order to discourage the conversion of forested lands to other uses, such as cattle ranching and agriculture. To do so, it is essential that (a) sustainable harvesting levels be identified, (b) potential negative impacts of NTFP harvesting to biodiversity and the forest ecosystem be identified and minimized in project activities, and (c) project activities be designed to minimize the possibility of NTFP overharvesting by groups outside of the project but encouraged by project success.

EAs  
for  
NTFPs

We have not explicitly examined the environmental consequences of the NTFP dimensions of this project because specific products, sites and project activities have not be identified as yet and the environmental consequences will undoubtedly be product, site and project activity specific. We can, however, lay out some general criteria that the project and future environmental assessments

should follow when judging whether NTFP marketing will produce the desired goals of forest conservation and sustainable use. These should include, but not be limited to, an analysis of the population-level consequences of the recommended harvesting and resource management practices.

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- Note: Additional Bolivian referenced materials were utilized in various discussions. Many of these were in draft format, therefore not cited as formal references.

Appendix A List of preparers

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CLEAR: ( )  
CLEAR: ( )  
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LAC/DR/E:KMENCZER:KM:BOLFOREA.CAB  
07/01/93 647-8048  
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PRIORITY LA PAZ  
ROUTINE QUITO

LAC LA PAZ FOR M.YATES, QUITO FOR H.CLARK

E.O. 12356: N/A

TAGS:

SUBJECT: APPROVAL OF THE SUSTAINABLE FORESTRY MANAGEMENT  
PROJECT (BOLFOR) ENVIRONMENTAL ASSESSMENT (EA) (511-0621)

REF: LA PAZ CABLE 07328

LAC CHIEF ENVIRONMENTAL OFFICER (CEO), JAMES HESTER,  
HAS REVIEWED, AND WITH THE FOLLOWING CONDITIONS, HEREBY  
APPROVES SUBJECT EA WITH THE MODIFICATIONS IN REFERENCED  
CABLE:

WITH APPROVAL OF SUBJECT EA, PROJECT MAY PROCEED WITH  
PHASE 1 ACTIVITIES (0 TO 18 MONTHS). ACTIVITIES EVALUATED  
AND APPROVED IN THIS EA ARE: VEGETATION MAPPING AND  
BIOLOGICAL INVENTORY (GATHERING BASELINE DATA), NON-SITE-  
SPECIFIC TRAINING, SMALL PLOT RESEARCH AT BAJO PARAGUA AND  
MORIO, AS DETAILED IN SECTION 3.2 OF SUBJECT EA, AND  
IDENTIFICATION OF AND RESEARCH INTO NEW NON-TIMBER FOREST  
PRODUCTS.

(B) FOR SMALL PLOT RESEARCH NOT EVALUATED IN SECTION 3.2,  
A SUPPLEMENTAL EA SHALL BE SUBMITTED FOR APPROVAL TO LAC  
CHIEF ENVIRONMENTAL OFFICER.

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(C) NATURAL FOREST MANAGEMENT DEMONSTRATIONS, SITE-SPECIFIC TRAINING, AND DEVELOPMENT OF FOREST MANAGEMENT PLANS (COMMERCIAL HARVESTING OF TIMBER AND NON-TIMBER FOREST PRODUCTS) AND TECHNICAL ASSISTANCE IN SUPPORT OF THE PLANS WILL REQUIRE ADDITIONAL ENVIRONMENTAL REVIEW PRIOR TO PROCEEDING.

(D) SUPPLEMENTAL EAS, ENVIRONMENTAL REVIEWS (ERS), AND ENVIRONMENTAL GUIDELINES SHALL BE DEVELOPED AS DISCUSSED IN SECTION 6.0 OF SUBJECT EA. A SUPPLEMENTAL EA AND GUIDELINES WILL BE DEVELOPED FOR THE FIRST FOREST MANAGEMENT PLAN (FMP). THIS WILL BE THE BASIS FOR SUBSEQUENT FMPS. FOR SUBSEQUENT FMPS, ENVIRONMENTAL REVIEWS WILL BE CONDUCTED THAT WILL DOCUMENT COMPLIANCE WITH GUIDELINES AND APPLICABILITY OF EA OF ORIGINAL FMP TO SUBSEQUENT FMPS. APPROVAL BY LAC CEO IS REQUIRED FOR ORIGINAL FMP AND GUIDELINES. ERS OF SUBSEQUENT FMPS WILL REQUIRE MISSION ENVIRONMENTAL OFFICER'S APPROVAL. OTHER ACTIVITIES WILL REQUIRE ADDITIONAL ENVIRONMENTAL DOCUMENTATION, AS DISCUSSED IN SECTION 6.0.

(E) SEMI-ANNUAL MONITORING (SECTION 5.0) OF IMPLEMENTATION AND SUCCESS OF MITIGATION MEASURES SHALL BE SUBMITTED TO LAC CEO AND WILL BECOME AMENDMENTS TO THE EA. SEMI-ANNUAL REVIEWS OF MITIGATION SHOULD BE USED TO DEVELOP AND REFINE MITIGATION FOR FMPS. MISSION SHALL DEVELOP A STANDARDIZED FORM FOR SEMI-ANNUAL SUBMISSIONS TO LAC CEO.

(F) LAC/DR/E COMMENDS MISSION ON A THOROUGH EA THAT BLENDS SITE-SPECIFIC CONCERNS WITH PROGRAMMATIC ONES, AND THAT SERVES AS A MODEL FOR EA COORDINATION WITH PROJECT DESIGN. YY

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GCLA-01 RDAA-01 FMAA-01 STRD-01 STAG-02 ENGY-02 STFN-02
SEDP-01 GEO-01 SERP-01 SECS-02 AMAD-01 POCE-01
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TO SECSTATE WASHDC 9016
INFO AMEMBASSY QUITO

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FOR SECSTATE JEFF BROKAW AND KAREN MENCZER, LAC/DR/E;
PFRUMHOFF, R&D/EID/RAD, JKOSHER, R&D/ENR AND
KCONNINGHAM, FA/DP; INFO QUITO FOR HCLARK, REA/SA

E.O. 12356: N/A
SUBJECT: SUBMISSION OF BOLIVIA SUSTAINABLE FORESTRY
MANAGEMENT (BOLFOR) PROJECT EA

REFS: HESTER TO YATES CABLE OF 2/22/93; MENCZER TO
YATES E-MAIL OF 5/10

SUMMARY. MISSION HAS REVIEWED SUBJECT EA, AND HAS
DETERMINED THAT IT COMPLIES FULLY WITH ITS APPROVED
SCOPE OF WORK. THE DESCRIPTION OF RECOMMENDED PROJECT
ACTIVITIES, INCLUDING MITIGATIVE MEASURES TO INSURE
CLOSE PROJECT COMPLIANCE WITH REGULATION 22 CFR PART

216 AND SECTION 533 (C) (3) OF THE FAA, ARE SOUND AND
USEFUL, AND ARE FULLY CONSISTENT WITH BOLFOR PROJECT
GOALS AND OBJECTIVES. USAID/BOLIVIA ENDORSES THIS
ASSESSMENT (WITH ONLY MINOR MODIFICATION) AND
RECOMMENDS YOUR APPROVAL. END SUMMARY.

BACKGROUND

1. IN FY 1992 USAID/BOLIVIA CARRIED OUT AN INITIAL
ENVIRONMENTAL EXAMINATION OF THE SUSTAINABLE FORESTRY
MANAGEMENT (BOLFOR) PROJECT. IT RECOMMENDED A POSITIVE
DETERMINATION, AND LAC/DR/E CONCURRED WITH THAT
RECOMMENDATION ON JULY 16 (SEE LAC-1EE-92-41).
SUBSEQUENTLY THE MISSION DRAFTED TERMS OF REFERENCE FOR
AN ENVIRONMENTAL ASSESSMENT OF PLANNED PROJECT
ACTIVITIES, USING AS A POINT OF DEPARTURE REGULATION 22
CFR PART 216 AND SECTION 533 (C) (3) OF THE FOREIGN
ASSISTANCE ACT, AS AMENDED. THE TORS CALLED FOR A
MODIFIED PROGRAMMATIC EA, ONE WHICH WOULD COMBINE SITE-
SPECIFIC ANALYSES WHERE PROJECT ACTIVITIES ARE
ANTICIPATED, WITH GUIDELINES FOR SUPPLEMENTAL EAS WHEN
PRECISE FOREST MANAGEMENT PLANS WOULD BE DEVELOPED AND
PROMOTED, AND/OR WHEN SPECIFIC FOREST PRODUCTS TO BE
THE FOCUS OF PROJECT ACTIVITIES HAD BEEN CHOSEN. THESE
TORS WERE APPROVED BY LAC'S CHIEF ENVIRONMENTAL OFFICER
ON FEBRUARY 22, 1993. THE DRAFT EA WAS SUBSEQUENTLY
PREPARED AND PRESENTED TO THE MISSION AND THE GOB IN
APRIL.

PROPOSED MITIGATIVE MEASURES

2. USAID/BOLIVIA ENDORSES THE MITIGATIVE MEASURES
PROPOSED IN THE EA, WITH ONLY MINOR MODIFICATION IN
MEASURE NO. 1. THIS IS BECAUSE THE MISSION BELIEVES
THIS MEASURE, AS CURRENTLY WORDED, WOULD BE VIRTUALLY
IMPOSSIBLE TO ENFORCE. SPECIFICALLY, THE MISSION FEELS
THE WORDING QUOTE THE BOLFOR SILVICULTURAL RESEARCH
PRACTICES WILL NOT BE ADOPTED BY THE CONCESSIONAIRE
UNTIL PROJECT RESEARCH DETERMINES THE CONDITIONS UNDER
WHICH THE ECOLOGICAL SUSTAINABILITY OF THESE PRACTICES
CAN BE ASSURED UNQUOTE SHOULD BE CHANGED TO QUOTE THE
BOLFOR SILVICULTURAL RESEARCH PRACTICES WILL NOT BE
PROMOTED OR ENDORSED IN ANY WAY BY THE BOLFOR PROJECT
UNTIL, ETC., UNQUOTE. USAID/BOLIVIA ENDORSES ALL OTHER
MITIGATIVE MEASURES AS WRITTEN, AND AGREES WITH THE
EA'S CONCLUSION THAT QUOTE MANY OF THESE MITIGATIVE
MEASURES ARE BASED UPON THE CURRENT PLANS OF THE BOLFOR
PROJECT DESIGN TEAM AND ARE FULLY CONSISTENT WITH THE
PROJECT'S GOALS AND OBJECTIVES UNQUOTE.

3. COMMENT. THE MISSION IS PLEASED TO SEE THE EA'S
STRONG EMPHASIS ON BOTH FAUNA AND FLORA, AND ON
MEASURING IMPACTS OF BOTH TIMBER AND NON-TIMBER FOREST
PRODUCT HARVESTING ON BIOLOGICAL DIVERSITY AND BROAD
ECOLOGICAL SUSTAINABILITY (AS CONTRASTED TO THE
SUSTAINABILITY OF TIMBER HARVESTING ONLY). SUCH
ACTIVITIES COULD PLAY A CRITICAL ROLE IN HELPING THE
GOB AND BOLIVIAN FORESTRY SECTOR TO REDUCE THE

DETRIMENTAL IMPACTS OF FOREST PRODUCT HARVESTING.
IN ADDITION, THE EA'S CAREFUL PHASING OF ACTIVITIES,
WITH INITIAL RESEARCH IN PHASE I INFORMING DEVELOPMENT
OF COMMERCIAL-SCALE MANAGEMENT PLANS (SUBJECT TO
SUBSEQUENT EAS) IN PHASE II, AND WITH INCREASED
DIFFUSION AND ADDITIONAL MANAGEMENT PLANS IN PHASE III,
IS WELCOMED, AND IS SEEN AS BOTH PRUDENT AND PRACTICAL.
END COMMENT.

4. HOWEVER, USAID/BOLIVIA PROPOSES MINOR MODIFICATIONS
TO THE TEXT OF THE EA, AS FOLLOWS: A) P.2 OF THE
EXECUTIVE SUMMARY STATES THAT PRODUCTS SHOULD BE QUOTE
CERTIFIED BY THE GOB UNQUOTE, THOUGH MISSION FEELS
CERTIFICATION SHOULD BE THE RESPONSIBILITY OF AN
INDEPENDENT ENTITY AND/OR JOINT PUBLIC/PRIVATE SECTOR
COUNCIL, RATHER THAN THE GOB PER SE; THIS IS TO AVOID
ANY ACTUAL OR APPEARANCE OF CONFLICT OF INTEREST, AND
THEREBY TO INSURE BETTER RESOURCE MANAGEMENT AND GREEN
MARKET PENETRATION; AND B) THE EA REFERS TO POSSIBLE
ECOTOURISM ACTIVITIES, THOUGH THESE WILL NOT BE
INCLUDED IN THE BOLFOR PROJECT, PARTLY BECAUSE OF THE
STRONG INTEREST OF OTHER DONORS IN THIS IMPORTANT
FIELD.

DAP CONTRACTING AND THE EA PROCESS

5. USAID/BOLIVIA NOTES THAT THE BOLFOR PROJECT IS THE
FIRST IN LAC TO USE THE NEW, COLLABORATIVE QUOTE DESIGN
AND PERFORMANCE (DAP) UNQUOTE METHOD OF CONTRACTING.

USAID/BOLIVIA FOUND THIS HAD IMPORTANT IMPLICATIONS FOR
A) THE TIMING OF THE EA, AND B) COMPOSITION OF THE EA
TEAM. FOR EXAMPLE, WHILE EAS ARE OFTEN CARRIED OUT
NEAR THE END OF PROJECT DESIGN, DAP SEEKS TO ENCOURAGE
A CLOSE PARTNERSHIP BETWEEN THE MISSION, HOST-COUNTRY
GOVERNMENT, AND CONTRACTOR IN ALL PHASES OF DESIGN AND
IMPLEMENTATION. THE BOLFOR EA WAS THEREFORE CONDUCTED
AS AN INTEGRAL PART OF THE PROJECT DESIGN PROCESS, WITH

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SEVERAL EA TEAM MEMBERS PARTICIPATING FULLY IN VARIOUS PROJECT DESIGN MEETINGS WITH THE MISSION, CONTRACTOR, AND GOB. IN THIS WAY EA TEAM MEMBERS HAD SUBSTANTIAL AND REGULAR INPUT INTO THE PROJECT DESIGN PROCESS (IN PARTICULAR IN DEFINING RESEARCH AND TRAINING ACTIVITIES), AND THE MISSION AND THE GOB, IN TURN, PROVIDED SUBSTANTIAL INPUT INTO THE EA.

6. IN ADDITION, DAP ALLOWS THE DESIGN CONTRACT TO BE MODIFIED TO PERMIT THE SAME CONTRACTOR TO IMPLEMENT THE PROJECT. HOWEVER, UNDER MORE TRADITIONAL CONTRACTING METHODS PROJECT DESIGN -- INCLUDING THE EA, WHICH IS ALMOST AN ENVIRONMENTAL AUDIT OF PROPOSED PROJECT ACTIVITIES -- IS CARRIED OUT BY ONE CONTRACTOR, AND PROJECT IMPLEMENTATION BY ANOTHER. THIS PROVIDES A DEGREE OF OBJECTIVITY TO THE EA PROCESS THAT CAN BE ABSENT UNDER DAP. USAID/BOLIVIA HAS THEREFORE CONCLUDED THAT DAP REQUIRES SPECIAL PROVISIONS TO INSURE THAT THE EA PROCESS IS STRICTLY OBJECTIVE, FREE FROM ANY CONFLICT OF INTEREST. THREE OUTSIDE SCIENTISTS (REPRESENTING A BROAD RANGE OF ENVIRONMENTAL SKILLS) WERE THEREFORE ADDED TO THE CONTRACTOR'S EA TEAM, AND AS THE EA NOTES THESE SCIENTISTS QUOTE HAD NO

VESTED INTEREST IN THE OUTCOME OF THE DESIGN OTHER THAN TO ASSURE ITS ENVIRONMENTAL SOUNDNESS UNQUOTE. THE SOW ALSO REQUIRED THAT ALL EA TEAM MEMBERS APPROVE THE FINAL EA PRIOR TO SUBMISSION TO USAID, AND IN THIS WAY THE MISSION WAS ABLE TO INSURE THAT THESE OBJECTIVE ANALYSES FROM OUTSIDE SCIENTISTS WOULD BE INCLUDED IN THE FINAL EA DOCUMENT, INCLUDING THEIR RECOMMENDATIONS AND PROPOSED MITIGATIONS. (COMMENT: USAID/BOLIVIA RECOMMENDS THAT AID/W INCORPORATE THESE CONCERNS IN SUBSEQUENT DAP GUIDANCE, AND WOULD BE PLEASED TO ASSIST IN THIS REGARD, AS APPROPRIATE. END COMMENT)

7. USAID/BOLIVIA COMMENDS THE EA TEAM FOR THEIR THOROUGH ANALYSIS, AND IN PARTICULAR THANKS THE INDEPENDENT OUTSIDE EXPERTS HOWARD CLARK, PETER FRUMHOFF, AND JEANNINE KOSHER FOR THEIR INVALUABLE CONTRIBUTIONS TO THIS ACTIVITY.

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